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Superhuman Alphas: Heightened Senses

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Abstract
This paper provides an investigation into hyperesthesia and how certain senses are heightened in normal humans. This is then related to Rachel; a character from the 'Alphas' TV Programme.

Introduction
This is the second article from the series of papers: *Superhuman Alphas*. *Alphas* is a TV programme about a group of gifted people with heightened natural responses making them almost 'superhuman'. This paper investigates Rachel, an Alpha that has heightened senses and how mechanisms within the body enhance her senses. The three most used senses she are investigated in this paper: sight, touch and hearing. A single sense can become enhanced through reorganisation of the cerebral cortex, allowing more neurons to be available for excitation from specific stimuli.

Alpha - Rachel
Rachel has an enhanced sense of touch; in the series she can distinguish between different materials on contact because of her knowledge of fabric structures. Her eyesight can also be improved to examine objects at the microscopic level, and she can increase the strength of her hearing, but not beyond the natural frequencies. As well as being able to smell and taste to determine the composition of both. Rachel heightens her chosen sense by shutting down the rest of her senses [1].

Plasticity in the Cerebral Cortex
The increased tactile acuity can be associated with the reorganisation of the cortical circuits because of its 'plasticity'. Each segment of the primary somatic sensory cortex is responsible for responding to stimulation from separate sections of the body [2]. When the sensory activity is lost from one sensory input, reorganisation of the cortical levels allows the same neurons to become responsive to another sensory input; for example a loss of visual stimuli can result in the area becoming responsive to touch. This reorganisation across different modes of sense is known as 'cross-modal plasticity' [3]. The reorganisation can either be a permanent or transient change in the cortex; for example, anaesthesia of a region of skin causes the neurons, originally responding to this region, to respond to stimulation from the skin surrounding it. However, when the anaesthetic wears off, the organisation of the cortex returns to its original layout [2].

In Context
This paper hypothesises that it is this reorganisation that this Alpha has a seemingly 'natural' control over, although it is impossible to say how. A single sense could become enhanced through reorganisation of the cerebral cortex, allowing more neurons to be available for excitation from specific stimuli. These neurons become available because Rachel is able to 'shut down' her other senses in order to enhance one at a time for short periods of time. However, you do see her struggle to control her abilities as they overwhelm her [1].

Enhanced Tactile Acuity
An increase in tactile activity is well known in people who are blind. However, their increase in tactile acuity is through adaptation and through extensive use of touch to determine what objects are or to read Braille. Blind people were shown to use the cortical areas usually associated with vision when performing auditory or tactile tasks [4].

There was a 30% increase in the tactile ability of blind people compared to their sighted counterparts of the same age and gender. This was found by asking them all to distinguish the orientation of grooves etched into a surface. The gaps between

these grooves became increasingly smaller and blind people were able to tell the orientation when sighted individuals could no longer distinguish between the individual grooves. Blind people, who were not blind from birth, also had improved tactile abilities when distinguishing between 3 dimensional shapes [5]. Therefore, it is theoretically possible for a person to increase their tactile acuity, making this a possible enhanced sense in relation to Rachel.

Enhanced Hearing Capabilities

Blind people often are better at performing tasks that rely on distinguishing the location a noise has emanated from in comparison with a person who has their vision [6]. Blind people can also distinguish between different levels of speech and are able to focus their hearing to the stimuli from a specific ear at a much higher level than sighted individuals. These results show that hemispheric reorganisation played a role at the sensory and cognitive levels when processing information in blind individuals [7].

Rachel is able to distinguish between different sounds and direction from which they are originating; this sensory capability also relates to the reorganisation of cortical levels.

Enhanced Visual Acuity

Magnification is usually associated with magnifying lenses; a convex lens is placed in front of the eye and the object of interest is placed just beyond the lens, resulting in the magnification of the object [8].

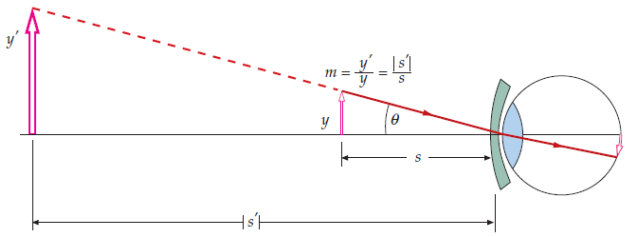

Figure 1 An object placed in front of a converging lens , with a height *y*, produces an image of *y'*, where the height of the new image equates to *my*, the magnification of the lens multiplied by the height of the original object [8].

The only possible way a human could do this theoretically, would be to have a section of the eye acting as a convex lens magnifying the image further. However, it is unknown of this occurring to this author; therefore, it is not possible through reorganisation of the cerebral cortex for vision to improve in this manner.

However, there has been evidence to suggest that adults who are deaf have an increase in visual performance compared to those who have hearing. The brain of an adult with audition must process the stimuli that they receive from both auditory and visual aspects of their environment. A deaf individual's brain only has to process the visual stimuli, which is processed normally in the auditory areas of the cerebral cortex like any other person; however, the stimuli are also processed in the areas of the cortex usually deemed the visual stimuli processing unit. It has been shown that deaf individuals respond faster and are more sensitive to visual stimuli than sighted adults [9].

Possible Enhancements

The improvement in eye sight is not possible without a change in the structure of the eye, not seen in nature; but, a more feasible improvement in eye sight is suggested here. This improvement involves an increase in photoreceptors, from three to four; a very small fraction of women have four genes corresponding to four different photopigments. This allows heightened colour perception [10].

Conclusion

If a superior reorganisation of the cerebral cortex is possible, than the senses deemed by this paper as possible, might have an increase in sensitivity. The increase in tactile and hearing capabilities in blind people show that reorganisation of the brain can lead to some senses becoming more heightened than others. Therefore, it is possible to increase the sensitivity of receptors as a larger portion of brain is allocated to a specific sense. However, the enhancement in visual capabilities suggested by the series is unheard of; it is unlikely that an individual is able to magnify an object enough to allow for finer details.

It is unknown as to what extent these senses could be enhanced and if it is anywhere near as sensitive as Rachel's, as shown by her actions in the series. In the series, Rachel becomes overwhelmed by her increase in sensitivity to stimuli, causing her to become unresponsive and agitated.

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