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Digital Anatomy

The concept of television encompasses the transmission and reception of visual and audio signals over a medium, usually air. Television technology relies on three technological developments. First, video cameras capture visual and audio components and transform them into electronic signals (Arnold et al. 3). Second, transmitters relay the electronic signal, analog or digital, over the air (Arnold et al. 11). Third, a television set receives and converts the encoded visual and audio signals into images and sounds (Silva). As a result, people can watch their favorite programs from their homes, including live news broadcasts. Therefore, for people to enjoy watching television from their homes, they make use of a variety of technologies. Besides, many industries come together to facilitate the provision of television services. These industries include broadcasting companies, television set manufacturers, and video content producers. Changes in the video, display, sound, and signal technologies have transformed television viewership from analog black and white televisions to digital color televisions.

Television Cameras

Television cameras work according to the same principle as human vision. For a person to perceive an object visually, light reflected or emitted by the object travels through a medium into the eyes. The eye has several parts that facilitate the formation of an image in the brain. At the front part of the eye, the pupil allows light to pass through a narrow opening. The light then

travels through a system of lenses that focuses the light to the back of the eye, specifically the retina (Ratnayake et al. 4). At the retina, the light falls on color-sensitive photoreceptors known as cones and rods. The cones and rods then convert the light into electrical signals that travel to the brain for interpretation. Television cameras work similarly (Arnold et al. 3). Light travels from the object into the camera through a series of lenses. The lenses focus the light onto a light-sensitive film or electronic light detector. The specific technology used depends on the type of motion picture displayed.

Older motion picture cameras and newer television cameras use different technologies for detecting and storing images. In older models, the cameras captured the image in still frames. The production of motion pictures would then rely on the displaying of these frames in quick succession (Arnold et al. 183). In contrast, modern video cameras store images in digital formats. Essentially, the light from the object falls on electronic light detector chips that convert the light into a digital electrical signal. The camera has to capture at least 24 snapshots in a single second to give the illusion of a video, or rather, moving pictures (Ratnayake et al. 5). The human eye's persistence of vision determines the minimum frame rate of video cameras. Notably, if the frames captured and displayed do not reach the 24 frames per second threshold, the human visual system detects the transition from one frame to the next. The above represents the general principles of video cameras.

A deeper perspective on video cameras requires an examination of the workings of the electronic light-detector system. Essentially, the light-detector utilizes the same principle used while copying an image. One of the techniques used to reproduce artistic masterpieces involves the subdivision of the masterpiece into a grid, followed by the transfer of information from the

smaller square regions into the corresponding regions of the forgery. The transduction of visual images by old-fashioned television cameras relied on the same principle. Through a process known as raster scanning, the light detector would scan the image one line at a time (Arnold et al. 3). As a result, the camera would generate 525 lines of colored light for broadcast. Raster scanning technologies commonly used included NTSC and PAL, which used 525 and 625 lines respectively (Arnold et al. 3). However, modern cameras use a different approach to signal transduction.

Advancements in semiconductor technology have enabled the development of sophisticated image transduction technology. Instead of scanning an image one line at a time, modern television cameras use semiconductor microchips, such as CMOS sensors (Crawford and Joler). The camera lenses focus the light from the image onto the chip, which converts the color patterns of the light into a digital signal (Crawford and Joler). Since digital cameras rely on the same transition technology, the digital signals generated have 720 or 1080 lines (Smith). This means that modern cameras have the potential to capture more details. Additionally, while some cameras use only a single microchip to capture the color image, other cameras use red, green, and blue light-sensing microchips to capture the details in an image. From these three primary colors, differences in intensity and frequency can produce all the color differences in the image (Woodford). After the capturing of an image sequence and transduction of the signal, the next step in television technology involves the transmission of the signal from the broadcasting company to viewers.

Signal Transmission

The transmission of audial visual signals over the air relies on the principles of wave propagation. Similar to sound waves, the electromagnetic spectrum possesses wave properties. Essentially, the propagation of light waves shows similar properties to that of sound. Some of the specific attributes of waves include properties such as frequency, amplitude, and wavelength. When a person shouts, they produce sound waves with a high amplitude. Loud noises have more energy and thus travel further before obstacles dampen them. In television broadcasts, transmission relies on the radio wave section of the electromagnetic spectrum, characterized by a frequency of approximately 10^4 hertz and a wavelength of 10^3 meters (Arnold et al. 248). The power of the transmitter determines the amplitude of the signal. Therefore, for the radio waves to reach viewers far away, broadcasting companies use high power transmitters. However, this model of signal transmission has become outdated in light of technological advancements.

Television manufacturing companies currently advertise their products as digital or smart televisions. The distinction stems from the changes in radio wave transmission technology. Previously, television broadcasts utilized analog radio waves to carry the visual and audio signals. By definition, an analog signal refers to a continuous signal that varies slowly over time (Arnold et al. 9). The example of a sinusoidal wave depicts the concept of an analog signal. However, due to the practical limitation of the analog signal used in television broadcast, most countries started to faze them out around a decade ago. For instance, analog television signals shared a similar bandwidth with numerous communication devices and interference affected the quality of pictures received (Arnold et al. 10). Additionally, analog signals carried a lesser number of channels in a given bandwidth compared to digital television signals. In contrast to analog signals, a digital signal represents data in discrete values. A square wave represents one

form of a digital signal. With the introduction of digital signals for television broadcast, broadcasting companies can transmit more information in their subscribed bandwidth and include more functionality (Smith). However, television is slowly drifting away from the traditional broadcasting model.

In today's world, most people in high-income nations rarely watch television broadcasts transmitted over the air. Cable television uses physical fiber-optic cables to transmit television signals from the broadcasters to the viewers. Another business model of modern television involves the utilization of the internet to stream video content hosted by a service provider (Smith). Another form of television pertains to satellite television, where the television signals travel to a satellite in space before a viewer receives them from over a greater geographical distance. These new models of television have enabled the increased functionality of television services (Smith). For instance, cable, satellite, internet, and digital television allow service providers to implement a subscription business model, where viewers have to pay to watch. The ability to transmit more information within a single bandwidth facilitates this business model since the service providers can transmit signals to prevent unsubscribed viewers from watching.

Television Receivers

Once the televised signal reaches the television set, its purpose pertains to the conversion of the signal to image and sound. The television set uses the reverse approach to that employed by television cameras. However, the display technologies used by various television sets function in different ways. First, the processor in the device splits the signal received via the antennae into an audio and visual signal. The audio signal proceeds to the speakers, where the diaphragm connected to a copper coil immersed in a magnetic field vibrates to produce sound depending on

the current supplied to the coil (Woodford). The technology behind the conversion of the visual signal to images depends on the screen technology used. The first generation television sets used a cathode ray tube (CRT) to form images on the screen (Silva). Advancements in technology have resulted in the development of other screen technologies such as Liquid Crystal Display (LCD), Plasma, Light Emitting Diode (LED), and Organic Light Emitting Diode (OLED) screens.

The workings of CRT television sets are more complex than those of recent flat-screens. Starting with the visual part of the television signal, the electronic circuit divides the signal into red, blue, and green signals. These signals operate three electron guns housed in the CRT (Woodford). When the three guns fire electrons towards the phosphor-coated screen, rings of electromagnets steer the electrons to sweep from one end to another (Silva). The electron beams pass through a mask that focuses them to hit specific regions of the screen. The electrons light up red, green, and blue dots, which form a colored picture (Silva). CRT television sets have the disadvantage of being big and consuming a lot of energy.

Unlike CRTs, LCD television sets are slimmer. The screen is constituted by millions of picture elements referred to as pixels. A single pixel contains three subpixels representing the three primary colors. Picture formation relies on the switching on and off of individual subpixels. Specifically, the switching on and off mechanism utilizes liquid crystals that twist and untwist. Plasma screens operate in a similar manner to LCD screens (Silva). The difference between the two concerns the composition of the pixels. For plasma screens, each pixel contains a microscopic lamp filled with plasma. Lastly, LED and OLED screen technologies utilize light emission semiconductor technology (Silva). The difference between an OLED and an LED

television display involves the use of organic carbon-based plastic in place of conventional silicon-based semiconductors (Silva). Although the picture quality of OLED television is superior to that of LED and LCD screens, OLED displays consume a considerable amount of energy.

As technology advances, viewers demand higher specifications from television manufacturers and content providers. The television manufacturing industry is currently focusing on one area to establish a competitive advantage. Specifically, television manufacturers engage in technological development activities to increase the resolution capacities of their televisions (Smith). One approach to accomplish these goals involves the development of better screen technologies such as OLED and Quantum-dots LED screen technology (Smith). A second approach entails the improvement of television cameras to capture high-quality images beyond 720 and 1080 pixels. Currently, television manufactures have achieved the ability to have television sets process 4K and 8K videos (Smith). As the specifications of television sets increase, the prices become prohibitive. Additionally, not every television service provider has the potential to keep up with the technological changes. Therefore, the preference for one television set technology over another depends on several factors.

Social-Economic Aspects

As already highlighted, the current focus of television manufacturing companies regards the production of television sets with the ability to produce high-quality images. However, the development of these technologies relies on the availability of huge financial resources. Coupled with the large number of competitors in the industry, this means that television manufacturers cannot afford to invest in a technology that will not meet consumer expectations. For instance,

LG and Samsung have introduced their flagship television screen technologies using OLED and QLED technologies (Smith). However, none of these industry leaders appear to commit to their technologies. The reason for this reluctance is the fear of investing in the establishment of expensive production plants without the guarantee of long-term operations. This scenario illustrates a definitive characteristic of modern technology. Specifically, technology becomes outdated at a very high rate. High obsolesce rates also affect the financial aspect from the perspective of consumers. For instance, before the introduction of flat-screen television sets, the size limitation of CRT television satisfied consumers (Silva). However, the size of flat-screen sets continues to increase, prompting consumers to change their television sets regularly.

Another important aspect concerning television regards its impact on the health of viewers. Unlike mobile phones, which emit electromagnetic waves, conventional television sets do not expose viewers to radiation. However, television screens do have an impact on sight. According to research studies, the blue light emitted by television sets causes damage to the retina (Ratnayake et al. 2). According to the research, the dangerous molecules created by blue light speeds up the degeneration of vision (Ratnayake et al. 5). Sight issues might also come from the flickering of television sets as they refresh images. Additionally, watching television at night affects the viewer's circadian rhythm by lowering the production of melatonin, responsible for inducing deep sleep (Boyse). As a recommendation to counter these negative effects of television, one should install a blue light filter. Besides, new television sets come with a software application that can turn on blue light filtering. Another protective measure involves the use of blue-light blocking glasses or contact lenses. However, reducing the time one spends watching television is the best approach to avoid these negative health impacts.

Closely related to the health impacts associated with watching television is the impact it has on the social well-being of children. According to research, young children spend a considerable amount of time watching television (Boyse). Based on their age group, children between two and five years old spend about 32 hours per week watching television. Additionally, in over 53% of households in American, 7th to 12th-grade children have no restrictions concerning watching television (Boyse). While television makes a positive contribution to the lives of children, its negative impacts draw more concern. One of the negative impacts of television in young children concerns the minimization of physical playtime (Boyse). When television engages children, they have no time to play with friends, a necessary aspect of development. In older children, television programs expose them to immoral behavior (Boyse). For instance, teenagers might develop an interest in alcohol from watching programs that depict alcoholism as being acceptable. Restricting the duration and programs children watch on television can counter these effects.

Television technology has changed considerably since its invention. First, television cameras have evolved from raster scanning to the implementation of electronic semiconductor light sensors. These technologies are involved in signal transduction. Concerning the transmission of television signals, digital, internet and cable television have replaced the analog signal. This aspect has also revolutionized the business model of television broadcasting services. Finally, television sets have evolved to integrate better screen technologies. Advancements in screen technology involved the shift from CRT to LCD then to LED and plasma technologies. The resolution capabilities of television sets define the competition among manufacturers. However, television raises a number of concerns in society. First, television sets

cause several negative health impacts on viewers. Second, it limits proper development in children and exposes them to immoral social practices. The last issue concerns the aspect of consumerism facilitated by rapid technological changes. Since television also confers some benefits, the best approach to counter these negative impacts is to practice restraint and avoid watching television to an excessive degree.

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