Interface Programming

CIS3149

James Fletcher

25397869

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# Introduction

# Task One

## Introduction

The intention of this task is to outline how human computer interaction (HCI) have evolved throughout their lifespan. HCI is exactly what the name suggests, it is the method in which the user interacts with the computer. The methods of application within the HCI field have expanded tremendously over time as Shneiderman is put forth in Rodgers’ (2012). Carrol (2009) stating that HCI grew in popularity on conjunction with the emergence of personal computing towards the latter stages of the 1970’s.

## Timeline

HCI has improved massively since the inception of computers from the earlier form of calculator to computer-to-computer interaction as demonstrated in the more modern programming usable interface (PUI).

The first believed computer was the calculating clock built by Wilhelm Schickard in 1623 (Freiberger and Swaine, n.d.). This calculator worked using 9 wooden slats comprising of numbers as well as 6 cylinders spanning the front of the machine with Napier’s logs laid over top (Freid and Sweitzer-Lamme, 2014). Napier’s log is an early mathematical logarithm that focused on the idea of geometric progression (The Open University, n.d.), which upon application to this early form of calculator would provide reason for the given output. In 1920, Thomas de Colmar progressed the calculator by inventing and producing the Arithmometer, which would become the first calculator to be mass produced, with production being maintained for 90 years (Freiberger and Swaine, n.d.).

The Jacquard loom punch card machine was a revolutionary step in computing as this machine allowed detailed patterns to be etched into fabrics and mass produced for the first time in history. The use of binary for this machine opened many doors for similar methods to be used and expanded upon going forward, which would become apparent when IBM released the IBM computer card in 1928. This improved punch card system would include 45 columns and 12 punch positions which would allow for much larger stores of data as well as the use in more complex tasks due to the ability to write lines of code (IBM, n.d.).

In 1945, Mauchly and Eckert created the ENIAC (Electronic Numerical Integrator and Computer). This revolutionary machine was the first general-purpose electronic computer (University of Pennsylvania, n.d.), taking up a 1,500 square foot room and consisted of over 70,000 resistors, 17,000 vacuum tubes, and 10,000 capacitors. The primary focus of this machine was to calculate artillery range tables however, the flexibility of the machine meant it was capable of being reprogramed for many other uses (HP, n.d.).

Another machine that was developed during the second World War was the Enigma Machine. This infamous deciphering machine was integral to the war efforts against the Axis of Power as through the use of this machine, the British were able to decipher German communications in order to counteract any plans they were making on the war front. The Enigma machines settings gave 15 quadrillion possible solutions however by the end of the war “the British were reading 10 percent of all German Enigma communications” (CIA, n.d.).

In 1945, 30 years before the invention of the personal computer and 50 years before the advent of the world wide web (MIT, n.d.), Vannevar Bush put forth the idea of a device in which “an individual stores all his books, records and communications which is mechanized so that it may be consulted with exceeding speed and flexibility” (Bush, 1945). This machine which he coined the “Memex” would be a revolutionary method of supplementing one’s memory as they suddenly became able to store and retrieve data in a way that was never previously possible. Whilst the implementation of this method in the present is vastly different that the technology available at the time, the principle of the idea is vital to how the world operates on a day-to-day basis.

Time sharing was an idea put forth to allow multiple users to access a computer system without interrupting each other. This idea was put forth by John Backus in 1955, who theorised that the large computers could be used as several small ones (IBM, n.d.). This theory would be put into practice in the early 1960’s as IBM incorporated keyboards and individual terminals to allow many people to work without interruption (McCarthy, 1989).

The first interactive computer graphics program “Sketchpad,” was designed but Ivan Sutherland in the early 1960’s. This program allowed users to “visualise and control program functions” which would become a foundation of computer graphics and operating system interfaces (Pyfer, n.d.). Rodden and Blackwell (2003), claim the Sketchpad had a long-standing effect on how computers were perceived and had massive impact on a multitude of new evolutions including some of the current market leaders Macintosh and Windows. Sutherland (1963) claimed in his doctoral thesis that the Sketchpad allows for communications between man and machine to be slowed down tremendously as they become able to use line drawings instead of written statements (Sutherland, 1963).

One of the most impactful inventions to take place within the computer industry was completed by Douglas Englelbart with the invention of the mouse. Engelbart’s computer mouse, originally patented as the “X-Y Position Indicator for a Display System” (SRI, n.d.), consisted of a block of wood with a pair of metal wheels underneath that would track the X and Y movement of the mouse and a button(s) on top. Engelbart’s original vision for the project was to “broaden the connection between humans and computers” (Doug Engelbart Institute, n.d.). The mouse was so revolutionary that many personal computer systems still use a mouse as a primary form of control, although a much more refined and efficient model. Engelbart’s inventions did not stop with just the computer mouse, he also revolutionised the use of a keyboard, which before hand operated similarly to a type writer, to include the ability to delete keys also known as the backspace. He also implemented the copy and paste function and the ability to save files independently. Also, he showcased the ability to drag and move items within a list as well as the use of hypertext to link to other datasets (Landau, 2018). Not only did Engelbart innovate computing to a level that had rarely been seen, he announced all of these revolutionary ideas within one single demonstration referred to as the “Mother of All Demos” where he announced his oN-Line System (NLS) (Doug Engelbart Institute, n.d.).

Alan Kay was one of the pioneers that pushed computers towards a household item. His idea was to create a smaller computer that were easy enough for children to operate. He released a mock up design of a computer that was a flat panel display with a stylus, similar to a modern-day tablet (Barnes, n.d.). Whilst Kay did not manage to bring forth his vision into reality due to limited technology, his idea was eventually brought into fruition.

In 1965, Ted Nelson invented a model for creating and using linked context which he coined “hypertext”(Computing History, n.d.). This hypertext changed how information could be stored and accessed as for the first time, it allowed for data to be linked other data very easily. He also coined the term “hypermedia,” which has the same premise, except for the linking data would be elements such as graphics, video, and sound (W3C, n.d.). This idea is a vital part of how people manoeuvre the internet in the present, through the use of “hyperlinks” that link to other websites.

In 1975, IBM released their first portable computer the IBM 5100, which weighed 50 pounds and cost $18,000, which would equate to over $100,000 dollars in 2025 adjusted for inflation (HistoryOfInformation, n.d.). The “high cost and lack of interfacing capability” (Berg, n.d.) lead this to pale in comparison to the IBM 5150 Personal Computer which was released just 6 years later in 1981. Whilst IBM had made a name by creating a shipping all of their own products, in order to match the given timeline and cost scale, they purchased Intel’s 8088 chip and used Microsoft’s operating system. This allowed them to release their PC within the year as James Cortada (2019 cited in IBM (n.d.) claimed “the PC market was moving too quickly” to take normal means at risk of falling behind competitors. The computer was so well received that TIME magazine announced it as “Machine of the Year” replacing the annual “Man of the Year” and remains the only machine ever to win the award (McCracken, 2013).

The Xerox Alto was a personal computer not like any others upon its release in 1973. Many of the qualities that are taken for granted in current computers were available with this computer starting with a high-resolution screen, keyboard, and mouse. However, more than 50 years ago, these were far from a staple for a household to have. Another aspect which set the Alto apart from the others of its kind it that much like the computers of today, this PC was built as a tower computer to be kept under a desk with all the peripherals, mouse, keyboard and monitor, to be kept above (Brock, 2023).

WIMP is a graphical user interface invented at Xerox Parc, the creator of the Alto, and stands for Windows, Icons, Menus and Pointers (Teach-ICT, n.d.). The WIMP system was popularised by the Apple Macintosh and has since been co-opted by many others including being used for the Windows operating system (Interaction Design Foundation, n.d.). One of the main benefits of the WIMP system is that it is very beginner friendly as it a WYSIWYG (What You See Is What You Get) software, meaning that there will be no changes in visuals upon configuring an output, such as printing from a text editor (Kanade, 2023).

The Apple Macintosh 128K was originally described as “revolutionary” by the New York Times, however, due to the large price and low specs, it was quickly superseded by the next generation of PC’s. Isaacson cited in the LA Times (2014), states that the machine was a “woefully slow and underpowered computer”. One of the major selling points when it came to the Macintosh was the user-friendly interface that became one the first widely sold PC with a GUI and a mouse (Kirvan, n.d.). In 1986, Apple released the much improved Macintosh Plus, which included 1 megabyte of memory. With the improved capability of the new Mac, it opened up many possibilities to run new software, which made it very successful with creative people (O’Brien, 2014).

Few industries have progressed as quickly as the mobile phone industry. The original mobile phones consisted of a microphone, a speaker, an antenna, and could weight up to a kilogram. As they progressed, they got thinner and lighter, features have been added and removed. Some of the large changes made include the era of flip phones and slide phones. These phones were more lightweight and portable as more and more people got mobile phones, however they were quickly outclassed by phones such as the Blackberry and the iPhone as the Blackberry was an ideal candidate for the working man, whereas there were few alternatives that offered the personalisation of the iPhone. Whilst there have been other phones to challenge the iPhone since its release, there have been few if any challengers outside of the touch screen bracket. The modern day mobile phones are more powerful than dedicated personal computers of the past, with the iPhone 12 being roughly 5,000 times faster than the CRAY-2 Supercomputer designed for the United States Departments of Defence and Energy in 1980 (Adobe Acrobat Team, 2022).

## Evaluation

# Task Two

## Introduction

The objective of this task is to use creativity in order to create a scene in OpenCV using primitive shapes such as rectangles and polygons. The approach that was decided upon for this task was to create a football net and accompanying pitch with an animation on the ball that would move it into the net. The reasoning behind this decision was to explore how perspective can be achieved with primitive shapes and a limited background in the subject.

## Project at Work

|  |  |
| --- | --- |
| Figure - Football Drawing Frame One | Figure - Football Drawing Frame Two |
| Figure - Football Drawing Frame Three | Figure - Football Drawing Frame Four |

## Source code

Figure - Code for Scene Elements (2)

Figure - Code for Scene Elements (3)

Figure 7 - Code for Scene Elements (1)

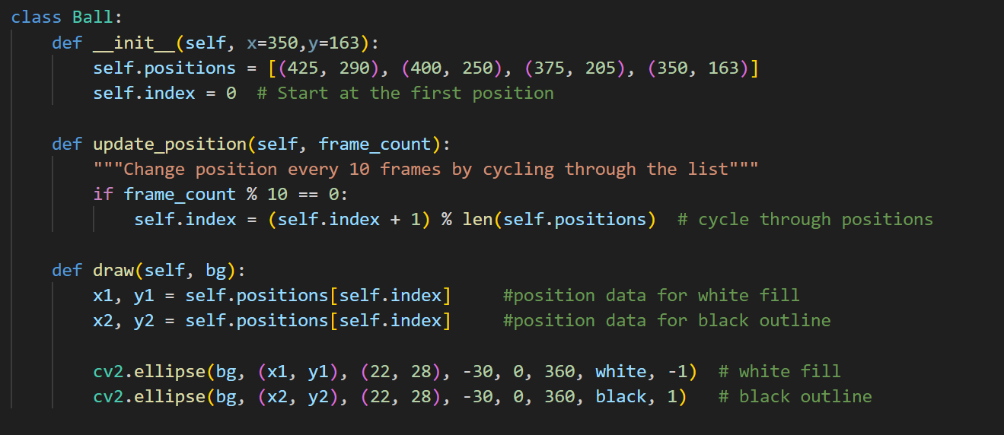


Figure - Code for Scene Elements (4)

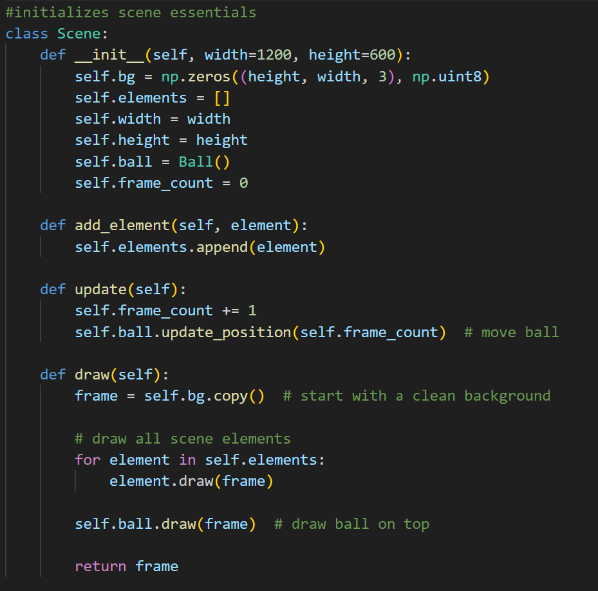


Figure - Adding Elements to Scene

|  |
| --- |
|  |
| Figure - Scene Logic |
|  |
|  |
|  |
|  |

# Task Three

## Introduction

The aim of this task was to use the provided Hand/Face tracking code to build a software that would take assumed gesture and use them in a creative manner. For this task, the gesture would display on screen, and if the person on camera would open their mouth, an audio file would activate.

## Project at Work

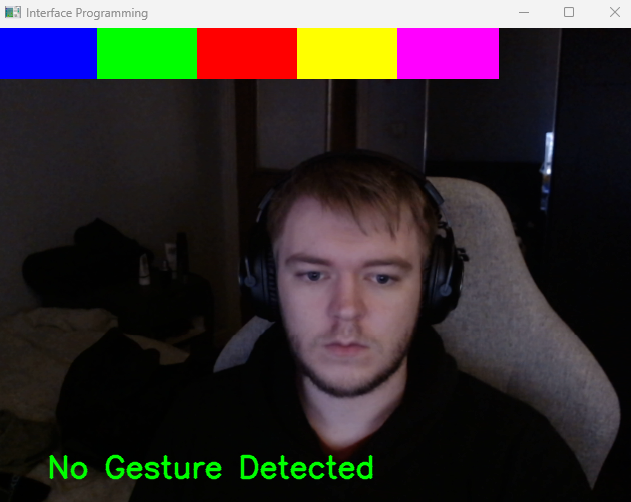


Figure - No Gesture

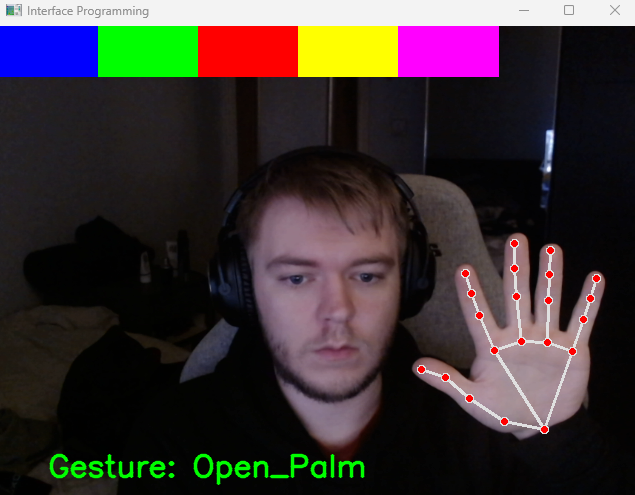


Figure - Open Palm

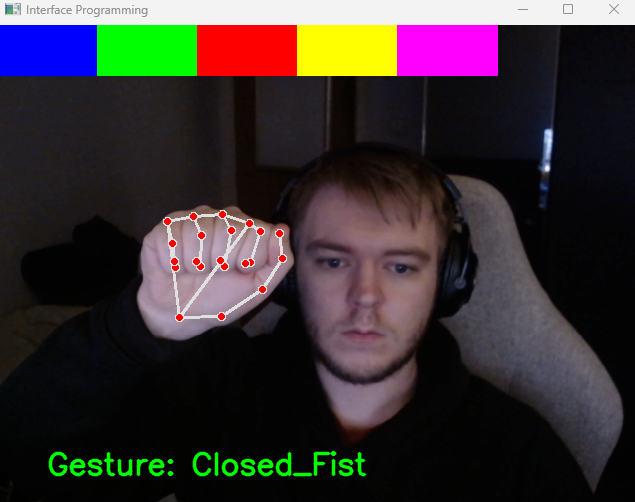


Figure - Closed Fist

## Source Code

# Task Four

## Introduction

This task was to build upon the work done in task three to use the gestures to interact with drawings on the screen. For this task the user needed a way of drawing multiple shapes on the screen as well as a way of clearing the screen of any clutter they may draw. Also added to this project would be the ability to draw from the tip of the users’ index finger as well as changing from an array of colours.

## Project at Work

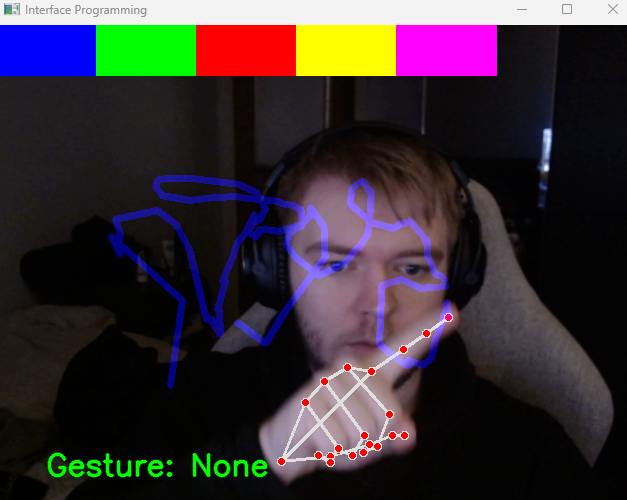


Figure - Drawing on Screen

## Source code

Figure - Drawing Shapes / Changing Colour

# Task Five

## Introduction

This task requires an analysis and evaluation of Human-Computer Interaction (HCI) guidelines, with a specific focus on gesture-based interactions. The objective is to research existing interface guidelines, including those from the Kinect for Windows Developer Toolkit, Nielsen’s usability heuristics, and mobile touchscreen principles. By comparing and evaluating these guidelines, the task aims to identify best practices for designing intuitive and efficient, simple gesture-based applications. Key considerations include usability, accessibility, environmental factors, and user experience. Based on this analysis, a set of guidelines will be developed to support the creation of applications that rely on gesture recognition for interaction.

## Guideline Research

## Recommended Guidelines

## Evaluation

# Conclusion

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