1) **Television:**
A television can be used in a variety of contexts – in a home, a restaurant or bar, an office, a store, and many more. Although this is used in various contexts, the design is fairly similar in all of these contexts. There are slight differences between the various television models, but they all have a similar design. However, the size of the television may be smaller or larger depending on the context and how many people will be viewing the television.

One strength of televisions is that they have a rectangular display. This is much better than having the television shaped as a triangle or circle. A rectangular display provides for optimal viewing, whereas a circle or triangle would cut out parts of the picture. Also, many televisions are becoming very thin in width. This takes up less space and makes it very easy to mount on the wall. In addition, the speakers placed on the sides of the screen and are designed to project away from television towards the viewer.

One weakness of televisions is that the buttons on the television tend to be very small. Although a remote control is usually used, it is not always used. It is hard to read the text on the television and figure out what each button does, especially if lighting is low. It would be better if the buttons, as well as the text labeling the buttons, were larger. Also, there are wires that are inserted into the television, and they can get very messy. They are often inserted into the back of the television, which can be difficult to reach since a television is often placed against a wall. Also, if a user would like to watch cable television, they need to connect to the cable jack on the wall through a wire. This requires the television to be in close proximity to the cable jack and limits the locations in which the television can be placed. If the wire could be eliminated, it would be much more convenient for users.

**Telephone:**
A telephone can be used in nearly any context, since communication is frequently required. Each telephone model differs in design. Telephones come in all shapes, colors, and sizes. Also, they are cordless phones and phones with cords.

One strength of telephones is that they order the number buttons in ascending order, making the numbers easy to find. Also, the numbers are in 4 rows and 3 columns rather than 1 row or 1 column, which would require more movement from one number to another. They telephone dial could also be in circular form, but the numbers would still be in ascending order. Another strength is that the phone receiver fits into the holder in such a way that it is secure and will not slide off of the phone. Additionally, the phone holder is designed such that it sturdy and will not fall over when placed on a flat surface.

One weakness is that telephones need to be connected to the phone jack. Therefore, they cannot be taken very far from where the holder is located. Even cordless phones can only be taken within a certain radius of the holder. Also, telephones tend to be large and bulky. They could be much smaller, like that of a cell phone. In addition, the telephone has to be
connected to the phone jack through a wire. Therefore, the telephone must be placed in close proximity to a phone jack. This limits the locations in which the telephone can be placed. It would be more convenient if it was wireless. This way, the phone could be placed anywhere.

**GPS System: (portable systems)**
A GPS system is typically used for navigation from one location to another. It can be placed in cars, bicycles, or other modes of transportation. It can also be carried as someone moves. GPS systems do not vary greatly in design. They are usually small and rectangular in shape. They come in all colors and can vary slightly in width and height.

One strength of GPS systems is that they are portable. They are not restricted to an area because of wires. They can be taken and used in multiple vehicles for navigation or carried around as the user walks. Another strength is that the latest GPS systems allow people to navigate through the system using a touch screen. This is much more convenient than having to use buttons on the sides of the system. Also, GPS systems are fairly small. They are large enough that the picture is clear and easily viewable, and also small enough that it does not take up too much space.

One weakness of GPS systems is that they use touch screens, which can easily be scratched or damaged. While this problem cannot be fixed without removing the touch screen feature, the screen could be improved to be more durable. Another weakness of GPS systems is that the speakers are not usually in the front of the system. To reduce the size of the system, the speakers are typically on the sides or back of the system, and are small in size. Bigger speakers could provide for better sound. It would also help to have the speakers on the front of the system, so that the sound is projected towards the user. Additionally, another weakness of GPS systems is that they are not very durable. They can easily be broken if they are dropped. This can be improved if they are slightly bigger or use a thicker material is used.

2) **Interviewee 1:**

1) Desktop is not mobile. It is not possible to carry it around wherever you go.
   Alternative: purchase a laptop
2) Desktop is heavy and difficult to move around.
   Alternative: purchase a laptop
3) It is difficult to figure out how to change some of the basic settings on the desktop, such as control panel and display settings.
   Alternative: need a different design that has all of these options in one easy-to-find location

**Interviewee 2:**

1) If there is a hardware problem, it is very difficult to diagnose the problem.
   Alternative: use diagnostic software
2) The desktop is not portable. You cannot take the desktop to class or the library.
Alternative: purchase a laptop
3) The design of the case does not allow for maximum airflow.
   Alternative: purchase a cooling pad

**Interviewee 3:**

1) There are lots of cords that connect to the computer, and they always get tangled up. “It looks like my computer threw up cords.”
   Alternative: need a different design that uses fewer cords
2) A wireless mouse is used to reduce the number of cords. However, it is very small and easy to lose. After it is lost, it can be difficult to locate.
   Alternative: a locating device for the mouse
3) The computer is composed two separate units, and takes up a lot of space.
   Alternative: need a new design with just one unit that is smaller – like the size of a laptop

These comments list a variety of design flaws, but the problem that seemed to bother people the most was that a desktop is not portable like laptops. Many people on campus use laptops, so it must be difficult for desktop users to not be able to take their computer with them wherever they go like laptop users. It is much more convenient to have a laptop if portability is a priority. Based on the interviewers’ responses, the other problems that were encountered were not as bothersome. While it is not possible to easily fix the mobility problem, many of the other problems can be fixed easily.

3) Below is the graphical representation of the study. The plot displays the time taken for each trial, as well as the best fit curve for the data. The best fit curve for this data is $y = 26.502x^{-0.5108}$ Thus, the learning constant is 0.5108 for this study. The subject clearly showed improvement, especially at the beginning of the study. There is a large difference between the first and the second trial because the subject looked at the first answer that was entered and used it as guidance when typing during the second. The subject also got slightly distracted as people were walking by, which resulted in some noise in the data. The source code is attached in a separate file.
4) Each menu item is 14 pixels in size.
   a) MT = a + b log (A/W + 1)

   a = 548
   b = 420
   W = 14

   A = 14 * 6 – We assume that we move past half of the items to reach an item on average. Since there are 12 menu items, half of those items would be 6 items. We then multiply this by the size of each item (14 pixels).

   MT = 548 + 420 * log (84/14 + 1) = 1727.089
b) 50/50:
   \[548 + 420 \cdot \log (112/14 + 1) + .5 \cdot \log (56/14 + 1)\]

75/25:
   \[548 + 420 \cdot .25 \cdot \log (112/14 + 1) + .75 \cdot \log (56/14 + 1)\]

90/10:
   \[548 + 420 \cdot .1 \cdot \log (112/14 + 1) + .9 \cdot \log (56/14 + 1)\]

Since the 90/10 calculation gives the lowest choice time of the three, then the absolute minimum choice time would be when 100/0 – if the choice is always a dynamic menu item. The maximum would be the opposite of that, which is 0/100 – or if the choice is always a static item.

c) One limitation of Fitts' law is that it predicts movement in only one dimension, which is not always sufficient. Also, there is not a consistent way to dealing with errors for Fitts’ law.