Assignment P2:

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1 QUESTION 1

To answer this question, I chose the one-hour period of time, starting from the moment I wake up on a weekday. Below is the list of five tasks I perform during this time, including the associating goals, the related interface I interact with, and the object(s) I use for my interactions.

Table 1 — Table of tasks performed during the selected hour

Task	Goal	Interface	Object(s)
Brushing teeth	Remove germs from the teeth and mouth	Buttons on electric toothbrush	Germs on the teeth
Make coffee with coffee maker	Prepare a cup of coffee	Coffee machine	Coffee
Writing down my plan of the day on my iPad	Having a written format of my plan of the day	Note taking application on my iPad	Words describing the plan (or plan)
Video Call with my parents	Interact with my parents	WhatsApp video call interface	Voice and video of myself and my parents
Blend fruits and vegetables with my blender	Make a smoothie to increase my fiber intake	Blender	Smoothie
Watch the news on TV	Get notified about the news	TV	Video and sound

1.1 First task- brushing teeth

I use an electric toothbrush to remove germs from my teeth. What I actually do is pressing the ON button on the electric toothbrush. Through some internal

electrical and mechanical processes, the toothbrush starts vibrating its tip (where the brush is). The brush itself operates on my teeth. Therefore, my interaction with the toothbrush (i.e., pressing the ON button) is far from the interaction of the brush on the germs (object).

Also, this task is not direct since I am not vibrating my hand or finger to remove the germs. Instead, I press a single button, which is not similar at all to the continuous vibrations created by the toothbrush in terms of directness.

I do not spend much time to think about the interface (buttons to choose on electric toothbrush) at this time. This happened after I went through a learning process. I now mostly focus on the task (removing germs from my teeth). The interface became invisible to me by learning. These days, I just pick up the toothbrush and do not even look at the button(s) because I even learned where the desired button is or what it does. I just press that button to do the task.

Previously, when I first bought the toothbrush, I was not familiar with its functionality. I was not even using an electric toothbrush before purchasing this new device. I had to check the manual to learn where the buttons are and what they are used for. It took me about a week to get comfortable with it. I am using this toothbrush for over five years now and I believe the interface became invisible to by learning and not the design.

1.2 Second task- Make coffee with my coffee maker

In order to make coffee, I use the buttons to operate with the coffee machine. I believe my interaction is far from the object of the interaction (i.e., coffee). The reason for that is by clicking on a single button on the coffee machine, the internal electrical and mechanical parts of the coffee machine get activated at different levels to perform the following steps: 1) bringing water to boiling temperature, 2) grinding the coffee in the coffee maker, 3) pour the heated water on the grinded coffee, and 4) guide the coffee prepared to the cup.

By clicking on the coffee maker's ON button, I indirectly manipulate the object (i.e., coffee). The act of clicking is not similar to the act of the above-mentioned steps. I only move my finger to push a button, but direct interaction requires much more effort.

I do not spend any time thinking about the interface nowadays. This is something that almost everyone does on a daily basis since I bought this machine three years ago. The task is what I mostly focus on. I believe the interface became invisible by learning.

Previously, when I first bought the coffee machine, I had no idea how it operates or what the use of each button is. I had to read the manual thoroughly to find out what each button does. After a week or two, I learned a lot about the device's functionalities. I now have a certain mode already set and all I do is to push the ON button.

1.3 Third task- writing down my plan of the day on my iPad

I use my index finger to write down my plan of the day on my iPad. I believe my interaction is not far from the object of interaction since I simply press down and move my finger to write down the desired letters of the words in my plan.

I think writing with my index finger on my iPad's screen is considered as direct manipulation. My finger/hand movement create the words' shape that I desire, and I only use my hands to create those words on the screen.

I did not spend much time to learn how to write my plan on my iPad's note taking application interface. The way that I write is very similar to what I was previously used to with pens and pencils. I believe the iPad's note taking application interface is invisible by design. Even novice users can figure out how to write things on this application in a matter of seconds.

1.4 Fourth task- video call with my parents

I use the WhatsApp video call interface to connect and interact with my parents on a daily basis. For this task, my interaction is not far from the object of the interaction. Both myself and my parents at the other end use the interface to interact directly.

Doing video calls is considered as direct manipulation. The interface enables one to interact with other people exactly the same way they talk to each other in normal life. One can talk in the same way and even show emotions. The tone of the voice is also transferred exactly the same way.

I do not think much about the interface during this task. It is the same as before when I was a novice user. I believe the interface is invisible by design. There is no prior knowledge required to do this task using the interface except for starting the call (i.e., accepting the call by pressing a button). Even kids are able to interact with others this way.

2 QUESTION 2

For this question, the task I like to discuss about is making a payment using my Apple watch. I wear my watch everyday and use it to make payments at the grocery stores, restaurants, and shopping centers. Previously, when I first purchase this watch, I spend a lot of time learning how to use my watch to successfully complete this task. I watched multiple online YouTube videos and fully read the device's manual to make sure I do not miss a step.

This watch has two buttons on the side ("Figure 1"). The upper button has a bigger size and is known as the digital crown or home button. The lower smaller button is known as the side button and is flat. With these two buttons, one can get access and activate their credit or debit card and make payments. The processes are described as below:

Figure 1 — Buttons on the Apple watch.

Using the upper button, the user must first press the button once to view the applications installed on the watch, including "Wallet". Then they need to click on the application, view the cards already setup for Apple pay and choose the desired one. They then tap their watch on the device used to make transactions at the store. This completes the payment task.

With the lower button though, the user must only press the button twice to get access to the "Wallet" application. They can then choose their desired card and make a payment by tapping their watch on the device used to make transactions at the store.

In my first days making payments using my Apple watch, I only knew how to get access to the "Wallet" application using the upper button. It took me a long time finding the application on my phone and selecting my desired card. Later, I found out about how to get access to the Wallet app using the lower button, which is much easier. For the purpose of this exercise, I am focusing on the lower button only since this functionality is what I use on a daily basis.

My thought process now can be described in three steps: thinking about 1) the need to pay for the goods I am willing to purchase, 2) pressing the lower button for two times, 3) selecting the desired card, 4) tapping my watch on the device used for transactions at the store. This is relatively a much shorter thought process than the one I used to have in the first days of using my Apple watch for making payments. Now, I know exactly where the lower button is. I am used to finding it only by the sense of touch, even when the watch is hiding under my long sleeves. Also, I know which card appears on the watch's screen and is activated for the payment when pressing the button for two times. I set the credit card that I regularly use to appear on the screen automatically so that I do not need to look for the desired card in all situations. For these reasons, I do not have to spend a lot of time focusing on the "Wallet" application's interface.

In order to improve the design that gets the user to the point of invisibility in a shorter time, I might redesign the watch in a way that it pops up the "Wallet" app at the desired time. With this specific change, there is no need to even press a button; hence, the thought process about the interface is shortened to a great extent.

In order to re-design the interface, I would add an option to the watch's interface to get triggered by user's voice (affordance principle- the users have immediate access to their voice in the context of shopping). This allows the user to just ask for their wallet by saying a few words such as "bring up my wallet" or "bring up my debit card", which is trivial to the novice users (knowing the user principle). This also eliminates the need for the user to manually press buttons which can work better for expert users (differentiating the user principle). This component

of the new interface enables quicker invisibility. The interface itself can be designed in a way that when activating "Wallet" manually, pops up a message notifying the user the option to use the voice-based option (principle to let the interface teach).

3 QUESTION 3

The task domain I chose is playing an augmented-reality video game.

When playing, the visual feedback received by the user can be categorized as: 1) visualizing objects that are fit into the sight limit of the user, 2) movements of the objects and characters in the game, 3) colors used for background, objects, and characters. Most of the current systems give the user visual feedback on a two-dimensional screen. However, some of the more advanced devices give the user the option to operate in a virtual three-dimensional space. This enables the user to have a better understanding of the environment since it is similar to the human eyesight in three dimensions.

The auditory feedback the user receives during the task include the background music designed for each section of the game as well as the alarms and notifications to notify the user about changes or alert the user about errors in the interactive interface. There are different ways to receive auditory feedback. For example, many users wear headphones when playing games. Current headphones mostly have noise cancellation option that allows the user to filter out the environment's noise and get engaged better with the auditory feedback related to the game.

The haptic feedback the user receives when playing an augmented-reality video game depends on the device used to play the game. For example, some devices require the user to interact with a joystick. There are some actuators embedded in the joystick that create small movements such as vibrations and tap. This way, when playing the game, the user constantly receives haptic feedback about the changes in the game. If there is an explosion happening in the game for instance, the joystick vibrates. If the user's character gets hit by another character, the joystick taps the user. These are some examples of the current types of haptic feedbacks included in the most common devices such as PS5 or Xbox.

In this section, I would like to use the three types of human perception discussed above (i.e., visual, auditory, and haptic) to suggest designs that give more informative feedback to the user when playing augmented reality games. First, in terms of visual feedback, it is possible to bring up notifications on the interface's screen warning the user about high level of fatigue. The fatigue level can be constantly monitored using a camera or biosensors attached to the user's body. In the case that the fatigue level was detected to be high, a visual trigger appears on the screen to alarm the user to take some rest. Second, for auditory feedback, it is beneficial to add specific sound(s) to alert the user when emergency alerts are sent out from national, state, or local government authorities. This feature is already embedded to iPhones, and I think it would be a great idea to embed that in the game interfaces. Third, for the haptic feedback, I believe there is much room for improvement. For example, the room temperature can change when the user's character is in a hot/cold environment. Another option is to increase/decrease the humidity of the room that the user is in depending on the game environment.

Sense of smell is another type of perception that can be added to assist with better immersing the user in the game environment. For instance, if the user's game character is located in an environment full of flowers, a scent of flowers can be dispersed in the room where the user is.

4 QUESTION 4

To answer this question, I chose giving the user control of the pace and offloading tasks from the user onto the interface to discuss as suggestions for reducing cognitive load in interface design.

4.1 Giving the user control of the pace

I recently bought an air conditioning unit that comes with a built-in dehumidifier. The work panel is shown in "Figure 2". In unit, one can set the mode to dehumidification mode, as indicated in "Figure 2". In this mode, the temperature and fan level are fixed. After setting the unit to the dehumidification mode, the user can no longer adjust the temperature and fan speed level to satisfy their needs. This is a noticeable drawback of the unit's interface since it does not let the user control the pace of air flow or the temperature.

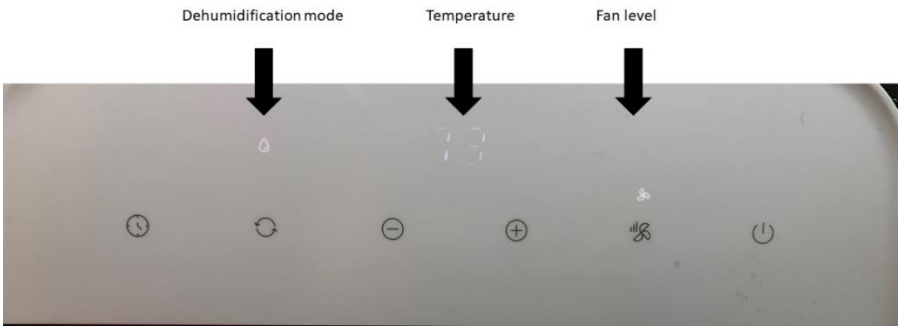

Figure 2— Work panel of the air conditioning unit with built-in dehumidifier.

In order to improve the design, they require to add options for controlling the fan's speed as well as the temperature. In order to do this, the buttons used to control the temperature (i.e., + and – buttons) need to be activated in dehumidification mode. For the fan, similar control buttons (i.e., + and – buttons) can be embedded into the design of the interface The current speed can also be visualized on the panel (interface) to let the user know about the exact speed of the fan.

4.2 Offloading tasks from the user onto the interface

Playing video games on PS5 imposes a huge cognitive load on the user. I use a joystick to play video games on a daily basis. One example of the use of joystick is to aim at a target of interest. In order to do this, my brain needs to follow the following process of thoughts: 1) identify the target, 2) identify my character's location, 3) identify the correct button(s) to set the aim, 4) press that button(s) to execute movement. This process of thoughts is only for aiming at targets of interest and are required at every moment. This imposes a great cognitive load on the user.

I believe including an eye tracker in the interface can offload a great amount of cognitive load from the user by shortening the length of process of thoughts. Today, eye trackers easily identify the gaze and blinks. Therefore, to implement eye trackers for the purpose of the task described above (i.e., aiming at a target), one can only gaze at the aim of interest. This natural direct interaction removes the need for 1) searching and identifying the correct buttons, and 2) pressing the buttons to set the aim.