FINAL REPORT
TOUCHLESS PAYPHONE

Introduction:
The rise of covid and touchless technologies has spurred interest in developing new designs for public use spaces such as payphones, which can offer both convenient communication and an opportunity to interact with a public space.

In the first stage, as part of our autoethnography, we discussed the advantages and disadvantages of a touchless payphone. During the second, prototyping stage, we proposed ways for users to interact with our device. This had features such as eye tracking, a virtual avatar, contactless payment, a large laminated screen, a virtual avatar, automatic doors, and multi-language processing.
The goal of our design was to be inclusive, with features such as a soundproof glass box, a ramp for wheelchair accessibility, and clear instructions, to cater to the varied UK population.
We used the method of asking users to fill out a questionnaire, at the start and end of our study, which looked to find which screen size was the fastest to use.

During our study, we timed users' abilities to complete a list of tasks, using either a screen size of 35 or 30 inches. Our numerical results found that the larger the screen size, the faster that users were able to use our touchless payphone, in 60% of the cases. Moreover, the qualitative results implied that 86.7% of our users think that there should be more touchless interactions in public spaces.

Summary of key findings from the individual autoethnography exercise

Autoethnography:
We developed our idea by finding out how different users will interact with a touchless payphone. We found that the best option would be to have the design able to; open a door without touching, a way to pay without touching, and a way to interact with the payphone user interface without having to touch it.
The main aim that we found out was that we wanted to create our design based around less abled/disabled individuals to give them ease of access when they would like to use a pay phone. To make this possible, our design would have to conform to different disabilities such as having a ramp to access the door, subtitles for hard-of-hearing individuals, and an interface to provide people who cannot hear the ability to interact and utilise the payphone.
We also want to provide many opportunities and usages when inside the payphone so we found that these design ideas would be the best to have:

- Natural language processing model.
- Virtual character/avatar to be more approachable.
- Contactless payments.
- Large laminated screen.
- Automatic door.

In our findings, we also tried to find out some of the common advantages and disadvantages of touchless interactions in a public space and try to get rid of some of the disadvantages they bring.
Advantages of Touchless interactions:

- Easy to use.
- Opportunity to interact with the phone booth to increase clarity and consistency.
- Robust and low cost of development.

Disadvantages of Touchless Interactions:

- **Missinput -** Obstructions can cause miss input or errors and are difficult to handle. We handled this by having a large screen in our design with an easy-to-use navigation structure in our designs to have less miss input.
- **Confusion -** For older users as they are less adept with technology. In our interface, we provide an easy-to-the-eye interface design with clear and concise instructions read out or with subtitles for users to understand how to use the touchless payphone more clearly.
- **Inference -** External Noise causing incorrect inputs or hearing difficulty in the setup guide. Our payphone box will come with built-in speakers and a more soundproof private design to

allow a more comfortable experience for the user. We also provide subtitles and clear instructions on the user interface to have less interference.

Description of one or more meaningful touchless interaction designs, and explanation of how these were informed by your results

When we were thinking of how best to design the features and interaction designs of a touchless payphone, we thought the best design approach would be inclusive to elderly and disabled individuals. However, we would also want a fluid and easy-to-use design.

We thought the best interaction designs would be:

- Soundproof glass box to provide privacy and little interference when calling.
- Large enough footprint for the phone box for people of all abilities and sizes (including fitting in wheelchairs/scooters). This is included in our design having a ramp for individuals with wheelchairs/scooters to access the phone booth with ease.
- Large Laminated screen for individuals to see the instructions clearly and how to use the phone booth with concise instructions.
- Instructions on screen or additionally with other options, as well such as subtitles, utilising the speaker and an automated voice to clear any confusion or miss input.
- Avatar on the screen to provide a more personalised experience.
- Motion detector for door and an automatic door.
- Secure important parts of the phone box (speakers, screen, etc…) with protective glass, and surveillance cameras.

Inside the payphone box, some of the design features we thought of were:

- Natural language processing to input telephone numbers and navigate the menu.
- Contactless prepayment.
- Audio and visual feedback using a virtual avatar and voice.
- Noise-cancelling to ensure the user's voice is picked up.
- Doors open automatically from the outside when not in use.
- On-screen help and clear instructions with a clear navigation structure for the user interface.

Description of two or more distinct personas of typical users of your new design

Persona 1:

Steve is 65 years of age, has low mobility and so requires an electric scooter to get around. He is also hard of hearing, so he wears a hearing aid.

Needs:

- Accessibility for those with mobility disabilities.
- A hearing aid loop will allow users with hearing aids to better hear the prompts given by the device.
- The ability to read instructions, rather than solely relying on audio.

Persona 2:

Anne is 30 years of age. She cycles back and forth to work each day. One day, she is in a rush and has left her phone at home and needs to make a call to work to inform them she will be late.

Needs:

- The ability to store a bike outside of the booth, or room inside to bring it in.
- Calls must be quick and easy to make so that users like Anne feel like it is worth stopping and using the device.

Persona 3:

Daniel is visiting from abroad. He only speaks a little bit of English. He needs to make a private call back home.

Needs:

- Users must be able to select a different language for the device to use. Any information displayed or relayed to the user should be available in a range of languages.
- The device must be able to understand other languages too.
- International calls must be available, with users being informed of any extra charge.

A scenario describing how your final system design behaves, and how users interact with it in various appropriate non-touch use-case situations

From persona 1, Steve has low mobility and is hard of hearing. A scenario to understand how Steve would interact with the touchless payphone would be that Steve would have to enter using a ramp and have a suitable room for his scooter to fit inside. If Steve is wanting to use the touchless payphone he would want clear and concise instructions on how to use the payphone to be more inclusive to the elderly, Steve would also want subtitles or on-screen help rather than a speaker/voice seeing how he is hard of hearing. Additionally, as Steve is wearing a hearing aid, our design could include a hearing aid loop to allow a much easier experience and less confusion on how to use the touchless payphone.

Clearly explained examples (e.g., using labelled images or diagrams) of your design's behaviour in a range of use-case situations)

Prototyping:

1) Users may make a mistake inputting the correct number...
   - The user has imputed an incorrect number "07897 324 980"
   - The avatar will display as well as say "This number does not exist"
   - It would then Go back to the main screen and issue a refund

2) User has used up all the given credit for phone calls, the Avatar asks if the user would like to pay for another 3 minutes.
   - Avatar's response: "This call is paused. To resume, please pay £2.00" – "Otherwise call will end in 1 minute"
   - User taps card
   - Avatar says "Thank you, your call will now resume"

3) Phone is not picked up.
   - Avatar says:
   - "07291 038510 cannot answer the phone, say yes to call again"
   - "Otherwise, "Stop" for a refund, or "No" to call another number".

4) Users dial a number with an area code or location out of covered areas.
   - The user has inputted an unsupported number "0312 123 123".
   - The Avatar will display text as well as say "This number is not supported as it is outside the range of covered countries".
   - The device would then "Go Back" to the main screen and issue a refund.

Explanation of how you will test your prototype in a way that gives users the impression it is working (even if it is not)

For this prototype, it will be tested by the following process. This process is limited and will only have set features as this will allow the user to get the impression that the prototype is working even when it is not. This prototype will also be complemented with pre-recorded voice lines, a simple dial and ringing sounds as well as pre-recorded messages such as a message to inform the user that a call cannot be completed at this time if there are any external errors, to give the illusion of the functionality of the prototype when the user wants to make a call.

Before the process starts the Avatar and the screen display a message which lets the user know that at any point during the interaction, they may say the "Help" command which guides the user through how the Payphone works and what commands it will respond to.

The process starts when the user walks up to the door of the payphone and the sensors detect the user outside the device and open the door to allow the user into the payphone. The door is then slowly closed behind the user once the sensors detect the user is inside. Once this process is over the user inside the payphone is greeted by Avatar that gives text instructions onto a laminated screen above its position as well as a pre-recorded voice line for blind users.

At any point from here on, if the user does not respond, the Avatar will wait on the most recent stage of the process and only go back to its greeting after 2 minutes and stay in that state until another command is given. All instructions will be displayed at the state of each interaction so that the user knows exactly what commands they can use at any time. If an instruction is given at any stage where it is not an option or other words are said by the user the device ignores the speech, this is so that the

device doesn't get confused at any point during the interaction. The device is also soundproof so no external noises will interfere with the device.

After the greeting, the Avatar will display and read to the user what language they would like the device to speak in. This is in the instance that a user does not speak the default English language set into the device. The instructions and individual languages that can be used by the device will be read aloud and displayed on the screen. The user is to say the language that they would like to use. After this task is complete the device will speak in this language for the rest of the interaction.
Once the language has been set the next stage of the device will ask the user if they would like the rest of the instructions throughout the process to be read aloud (usually in the case of a deaf user), as well as displayed on the screen which comes as a standard for this device. The user will then confirm with a "Yes"' or a "No" which will also be promoted by the Avatar. If the response is yes the speaker will be used, if the response is no then it will not use the speaker.

The Avatar proceeds and asks which country the user is calling (international calls cost more), at this stage the Avatar expects the user to have read the "Instructions of Use" which are on the side of the payphone.

The design for the instructions placed on the side of the payphone will be as follows:

Instructions of Use

Please speak clearly and face the microphone located on the right side of the Avatar. The Avatar will respond via text on the screen located above its screen and will also respond via speech if requested at the start of the interaction. All key prompts the Avatar will respond to will be shown on the screen accordingly. Please be sure to use the automatic hand sanitizer machine located next to the number pad if you accidentally touch something.
Thank you for using a Group 33 product.

International Calling Fees

Calls to France, Spain, and Italy cost 21p per minute.
Calls to the United States of America, India, Chinese cost £3 per minute.

Please be aware that as this is a prototype product we only allow calls to these 6 international countries.
Thanks for your patience

The user will then confirm the country through speech with all of the countries listed by the device so that the user knows their calling options and the Avatar will instruct the user to say a different country if a mistake was made.

This is the final state before the money is requested and in this state, the Avatar asks the user how long they would like to make the call. A standard call is for 3 minutes. The device will ask the user for a number between 1 and 10, each number meaning 3 more minutes on the call with 10 being 30 minutes long which is the maximum time allowed for a single phone call with this device, for example, if the users say the number 3, 9 minutes is added to the call and the user is charged at the current rate for the country that they are calling. For consistency's sake, we will use this same process for adding more minutes to the call once the call has started and the user wanted to add more time.
At this point, money is requested by the device as the device now knows the cost of calling for that country and the amount of time that the user wants to spend on the phone call. The User confirms the call by using touchless payment via card or apple pay etc. before being allowed to move on to the next stage of interaction.

The Avatar then prompts users to input phone numbers via speech, as each number is inputted it displays the number onto the screen and the number keypad lights up accordingly as they are spoken, as well as a simple dial sounds. An example of this colour-coded number pad is shown on the side of the page:

The Avatar will have instructions on the display screen and will also use the speaker if requested at the start of the process which instructs the user with the following commands. To clear the number inputted by the user the command is “Clear”. The device will output “Number Being Cleared” and reset the number to an empty space. To delete the previous number the command is “Delete”. The device will output “Deleting Previous Number” and delete the previous number, this command can be said multiple times in a row with the ability to delete more than one number. Finally, use the command “Enter” to call the number that has been inputted by the user. The device outputs “Calling Number” and calls the number with a ringing dial to show that the device has responded.
During a phone call with the device, it will give a 2-minute warning before the credit runs out. The Avatar will prompt a warning via text on the screen and if requested at the start a voice overlay. If the user does run out of credit during a call the call is put on hold, the Avatar will request for another payment and the touchless card reader will activate. The call will end after a minute if the user does not present more payment.

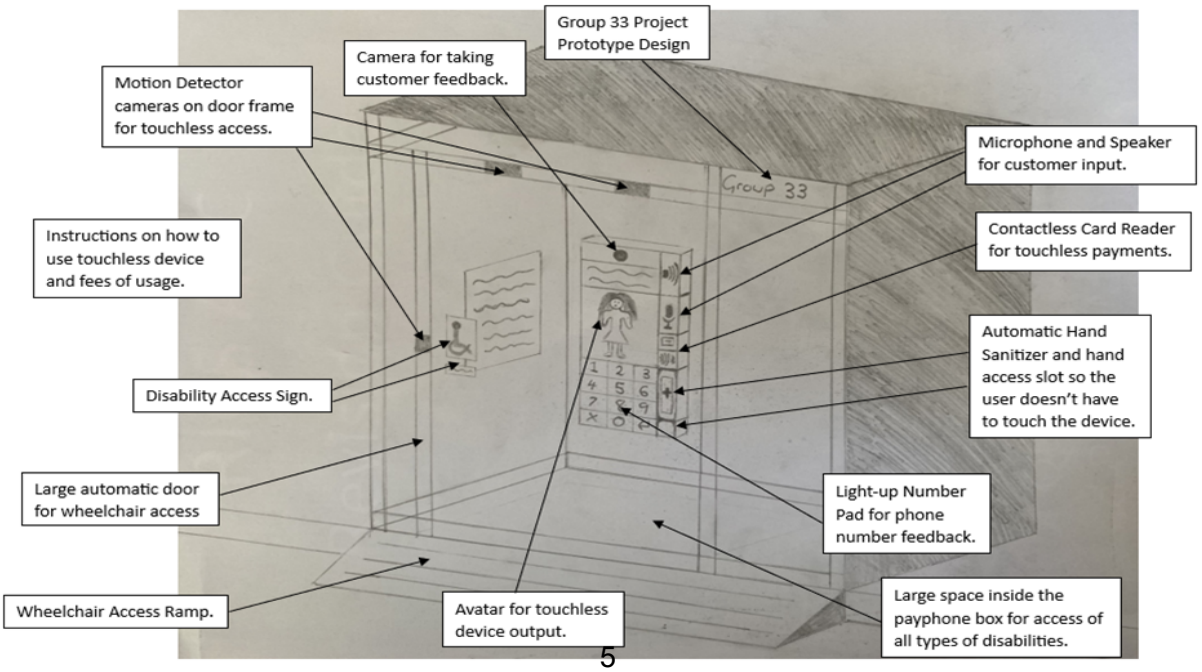
At any point, the user can say “Activate Payphone” during a call and the call will be put on hold. The Avatar will now be able to respond to the user. The follow-up options will be displayed on the screen and read aloud if requested at the start of the process with the following commands for proceeding with the device. The first command will be “Resume” which will resume the current call. The second command will be “Make Payment” which activates the card reader for more credit. This option has a further option which prompts the user to use the 1 to 6 number commands as described above with the initial charging. Finally, the last command will be “End Call” which ends the call and takes you back to the Avatar greeting.

At any point during this process the command “Emergency” can be used to call the emergency services. Is always displayed on the screen and instructions.

<u>Description and presentation of a convincing non-touch interaction design, including both paper-based sketches and photos of your prototype</u>

For our non-touch interaction design the user will walk up to the payphone and the sensors around the door will open the door to let a nearby user in. Once the door is open the user will be able to walk/wheel their way up the Wheelchair access ramp and enter the payphone. Once inside no more users will be allowed in until the previous user has left the device. The Avatar, display screen, number pad, speaker, microphone, camera and hand sanitiser is all located directly in front of the user as they walk in so that there is no confusion about where the user should be located within the payphone. The instructions for use can be found directly to the left of where the user is standing in an easy and accessible place. All of this is clearly displayed in the design drawing located below.

Prototype Non Touch Payphone Design:



A complete expert evaluation that includes all ten heuristics.

Evaluating:

1. **Accessibility of system status:** The large laminated screen on the payphone will display the status of the system, for example, when a call is connected or when the payment is successful. The avatar will also provide visual feedback to the user.
2. **Match between the system and the real world:** The natural language processing model will help match the system's language to the user's language, making it easier to interact with the system. The motion detector and automatic door also match the real-world behaviour of doors in public spaces.
3. **User control and freedom:** Users will be able to easily navigate through the touchless payphone's menu and options. The avatar will provide a more personalised experience and help guide the user without being too complex for older and less able people.
4. **Consistency and standards:** The touchless payphone's navigation structure will follow standard design patterns and consistency. For example, if there is an exit or back button, it will be located in the same place on all screens.
5. **Error prevention:** The large laminated screen and easy-to-use navigation structure will help prevent miss input or errors. The avatar will also guide the user to prevent confusion and errors.
6. **Recognition rather than recall:** The touchless payphone's interface will be designed in a way that users will recognize the options and functions instead of having to recall them from memory. The avatar will help provide a reminder of the available options. It will also give a brief tutorial if needed at the beginning of use.
7. **Flexibility and efficiency of use:** The natural language processing model will help users input telephone numbers and navigate the menu easily. The contactless payments and automatic door will also increase the ease of use for the UI.
8. **Aesthetic and minimalist design:** The touchless payphone will have a clear and easy-to-read and use design, with a focus on the most important information like the pricing and the phone number being inputted. The avatar will provide a more interactive and friendly experience.
9. **Help users recognize, diagnose, and recover from errors:** The touchless payphone will provide clear and simple instructions on the screen, as well as using the avatar to guide users through any errors and issues.
10. **Help and documentation:** The touchless payphone will provide clear instructions, both on-screen and with the help of the avatar, to help users understand how to use the system. Additionally, there will be clear documentation available in case of any issues or questions.

Show you understand each characteristic (e.g., more than just yes/no answers), via instances of where each one is well-applied or broken

1. **Accessibility of system status** will be applied via the virtual avatar at all times to make sure the user can view the system status as well as know what is going on. This makes sure that this heuristic is not broken as the user is always aware of what's doing.
2. **Match between the system and the real world**, natural language processing algorithms will be able to link the real world and the system via a seamless translation and interaction. This makes sure that this heuristic is not broken as the natural language program will understand all languages and be able to create a seamless experience
3. **User control and freedom** would be applied with the virtual avatar and the language processing allowing the user to seamlessly interact and go around the GUI via back commands and confirmation. But could be broken if the system misses inputs due to an error or background noise. This could be fixed with a noise isolation program or a more directional mic like a cardioid one.
4. **Consistency and standards** the avatar will stay on the screen at all times as well as a back button. This makes sure that this heuristic is not broken as a consistent theme and GUI is present.
5. **Error prevention** would be handled by the avatar giving clear feedback to the user in case of a miss imputed phone number or dialling to a country outside of the covered countries. This

makes sure that this heuristic is not broken as there is a protocol for most common errors and also allows for better debugging.

6. **Recognition rather than recall** the avatar will give a brief tutorial for interacting with the avatar as well as a list of commands that the avatar will follow at any time. This makes sure that this heuristic is not broken as the user is aware of all commands and ways to interact with the avatar preventing any type of user error.
7. **Flexibility and efficiency** of using the avatar and natural language algorithm will allow for simple navigation of menus. This makes sure that this heuristic is not broken as it is able to interact with anyone as well as being a nice seamless experience.
8. **Aesthetic and minimalist design** will be applied via the avatar being a consistent feature of the screen as well as a consistent colour scheme. This makes sure that this heuristic is not broken as its a consistent and clean GUI
9. **Help users recognize, diagnose, and recover from errors** the avatar will also handle this giving clear feedback to the user as well as producing an error log for the team to view and fix any bugs in the system. This makes sure that this heuristic is not broken as the user can just restart or go back due to an error and an engineer will get the error log to help apply a patch for the bug/error.
10. **Help and documentation** will be applied via the tutorial at the beginning and help command in case the user gets stuck or confused. This makes sure that this heuristic is not broken as it's clear to the user what's going on as well as allowing for help to be given at any time.

A practical, realistic and ethically-sound plan that will collect useful data, and could be used by others to replicate your study.

We will put our product's physical design to the test to find out how quickly the public can use it. Before going on public release, this will undergo testing during the prototype stage. To assess the usability of the design, we will examine it in a controlled laboratory setting with engagement from real users. Because we do not yet know which system will be faster, we will employ a two-tailed prediction, as we expect that there will be a difference. The distribution's positive and negative tails will be used in the two-tailed statistical tests.

We're going to change the independent variables between iterations of studies. The independent variable cannot be influenced by any of the participant's actions. The screen size as a factor of form is our only independent variable. Everything's going to be the same except for the size of the screen. The dependent variable is what will be measured, depending on how the participant performs. The time it takes to complete the task will be our dependent variable. When the screen size changes, one participant may take longer than another. The hypothesis that screen size X or Y enables our device to be used more quickly by users is associated with this dependency variable. The number of errors per unit of time, the number of users who make a specific error, and the user's personal views on the device are our other dependent variables in relation to other research questions.

To ensure fair testing, we're going to keep our control variables constant so that everything behaves exactly the same way. In order to avoid making it difficult for users to perform, all aspects of this setting will remain the same. Random variables are the ones that we allow to change in a random manner. This will take into account participants' experience levels, the temperature of the room, and the lighting in the room according to the time of day. We're going to let them be unpredictable because it doesn't influence the study at all. The speed with which a user interacts with the avatar needs to be measured every minute and second. In order to allow for rigorous testing rather than a time that is too short to complete all assigned tasks, users will be required to use devices for at least three minutes, including phone calls. We'll be taking an average after that.

We'll be tracking the amount of time that it takes for users to use this device. The analysis of numerical methods will be much simpler than qualitative because we are able to compare our means for the purposes of statistical analysis so as to give a more accurate answer. If 70% of the participants take longer using one screen over another, it is a clear indication that one screen is more problematic. In order to avoid bias when using two mediums, we shall provide each participant with the same set of information on a video platform under one condition.

A group design will be used, where individual tasks are assigned on a random basis to participants. Only one screen size shall be used by each participant. The fact that no order effects or biases are

observed, because only one condition is met, gives a positive signal for testing between groups. In comparison with group testing, however, more participants will be needed. The disadvantage is that we are going to have a representative sample of the general public with differing abilities, which will lead to variability in differences between participants.
We'll be using automatic logging, and we're going to build a script that analyses the results. There will be a separate file for each participant. In order to keep track of how long users take to complete tasks, we'll name variables wisely and record dates, hours, and seconds. In order to avoid data misplacement, this will be enabled automatically in the participant's folder.

Before the study begins, we will need to get ethical consent from the users. Users will be invited into the laboratory and will be explained what the study's about, why we are doing it, and If they don't like it, they can depart. Participants shall be required to read and sign the consent form, with one copy being sent to users as well as researchers. A bill of rights listing users' rights, such as the right to be treated with respect, will also be introduced. A Risk Assessment Committee which determines the ethics of a study shall be given access to that study. In exchange for their time, participants shall be paid in gift vouchers at an amount of £15 per half hour. During the study, users may leave at any time and still be rewarded with a voucher.

Detailed pre-, during- and post-study data collection methods, including a range of valid and useful questions that would lead to useful responses.

As we have chosen our research question, we will hypothesise about the way that users will perform with our design. In relation to our research question, our chosen hypothesis is that a screen of 35 inches (X) compared to a screen size of 30 inches (Y) will be faster to complete. We will test both sizes by timing users to see if our hypothesis is correct. We will also state our null hypothesis, being that “there is no significant difference between the mean time to complete our tasks using screen X versus screen Y. This could be as it is unlikely that there will be exact timing. After our experiment, we will conduct a statistical test, to determine whether or not our hypothesis is correct. A significant result from the statistical analysis means that the null hypothesis is highly unlikely to be true, thus one system is indeed faster than the other. Other possible hypotheses, from other research questions, could be that “Screen X is more accurate than screen Y” or that “Screen X is more user-friendly than screen Y”.
Our research questions are in relation to only changing the form factor of the screen size. Our main intended research question is, “Are users able to use a touchless payphone quicker on a screen of size 35 inches (X) in comparison to 30 inches (Y)?”. Another numerical research question is; “Which screen size of 35 inches (X), or 30 inch screen (Y), enables users to make fewer verbal errors?”. A qualitative research question may be: “Is a screen size of 35 inches (X), or a 30 inch screen (Y) more enjoyable for users?”. Or “Do users have more problems with using a screen size of 35 inches (X) or a 30 inch screen (Y)?”. This study will be used to find out all of these research questions. The quantitative, numerical, questions mean that we can log easily and do statistical analysis on them. The qualitative, subjective, questions allow us to review users’ experiences.

Before the study begins, we will have a questionnaire to collect demographic information relevant about the participants themselves. Such as the age range and gender of the participants, to ensure a wide range. We will ask about their highest level of educational attainment to gather an idea of how well people respond to instructions from the avatar. We will ask users to rank their hearing from 1 (poor) to 10 (excellent), which may affect how long they will take to respond to instructions. Household income may show whether users have enough disposable income for a smartphone. We will ask the user's current opinion of whether our device looks appealing and why. The lab study will be within the UK, and thus we require a variation of with UK users, English, French, Hindi, Mandarin, Spanish and Italian speaking. We intend to have roughly 70 participants.

At the start of the lab study, each participant will be welcomed. They will be informed via a video that explains what our device is, what we are expecting to find from this study and the tasks that they will have to complete. The participants will have to consent to being filmed and voice recorded. Every user will be evaluated in the exact same lab setting, and be given the same money amount via a contactless card that we provide. This includes providing the same instructions to all participants and asking the users to do the same task of calling a related language speaking researcher, for a minimum of 3 minutes, using the touchless payphone. There will be ceiling microphones, 360 degree cameras and lighting at all different angles, to capture what users are saying and their reactions to the

device, which users will have to give consent to. We are going to define the tasks for each user to complete as being:
1) The user walks into the kiosk.
2) Listen and read the instructions that are given by the avatar.
3) Choose the language that they want to speak in.
4) Decide if they want the rest of the instructions read out, as a yes or no response.
5) Pick the duration of the call as being 3 minutes.
6) Pay the given 3 minutes, from a contactless card given to them.
7) Say the given phone number “0734 4751”, to call the researcher.
8) Restart the process if a mistake is made.
9) Say “End call”, at the 3 minute mark.

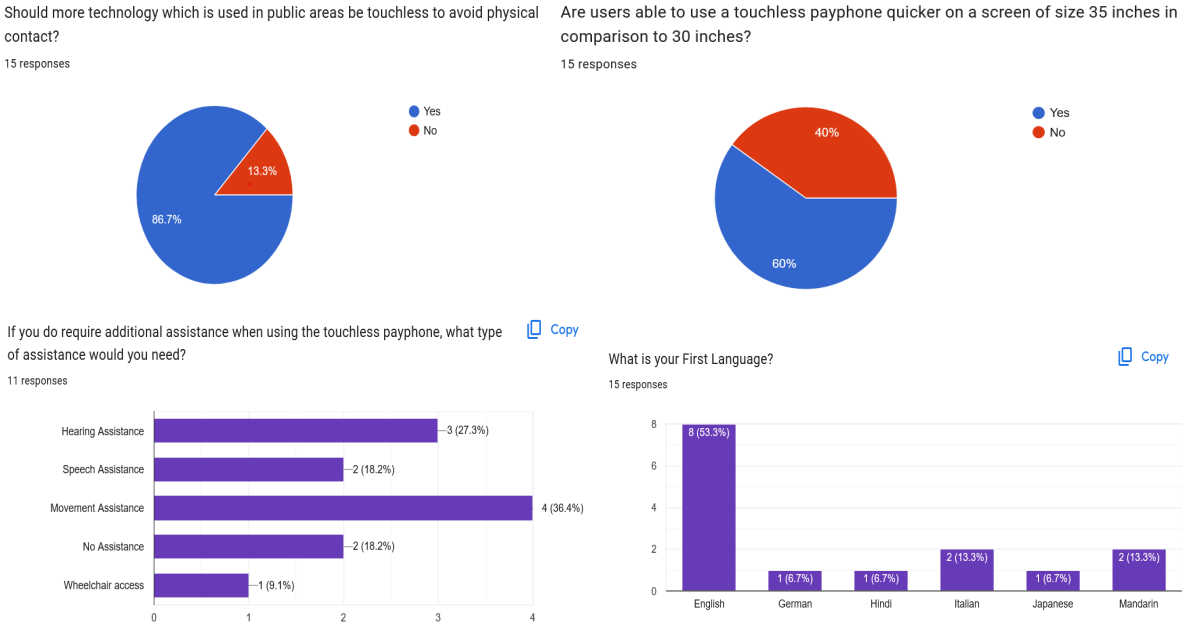
We will be timing from the exact same point and stopping the timer at the exact same spot for every participant, for a fair test. The given phone number of “0734 475” and tasks will be clearly displayed inside of the kiosk, to avoid any hindering learning difficulties.
We expect people to behave differently if they know that they are being watched. Thus, the experimenter will control everything outside of the lab, not behind a double-sided mirror screen. The experimenters will abstain from building a relationship with any participant to avoid influencing the users' perception of our device.

In our post-data study, users will be asked if they would like to be compensated £5 for answering a questionnaire, whereby the previous qualitative research questions will be asked. Another question will be to rate from 1 (extremely difficult) to 10 (extremely easy) scale, on how easy the device was to use and another rating for how enjoyable it was. The users will also be asked whether their first impression of the device has changed and why. Participants will be given the option to complete the same study again, in 1 year’s time, away from the product, to determine how easy something is to learn to use again. Once all of the questionnaires have been completed, we will cluster the qualitative points to answer our research questions and determine the percentage of positive opinions towards our devices.
A summary of the findings from your study, reflecting on its success, any issues arising, and implications for your design
After we've done our experiment to establish whether or not the hypothesis is correct and if it intends to accept or reject an invalid hypothesis, we will carry out a statistical test. We want to find out whether or not our data is random during the analysis part of the study. To make this possible, we'll test for the P value and see whether there is any likelihood of an effect not having been created by chance. A floating point number from 0 to 1 should represent the p value. The alpha level is set to 0.02, which means we have a 2% chance of our results being random. We can reject the null hypothesis and declare that the result is statistically significant if the P value is less than the alpha value. Otherwise, if over the alpha value, there was no statistical difference to be found. If we are to determine that our study constitutes an actual UK population sample, the p and alpha values will be applied. We expect that the normal distribution will be a bell curve, in which everything under it represents 100% of what we've got. At both ends, about 5% of the data is closer to the mean by a few scientific deviations.
In order to estimate the likelihood that our sample represents an approximate population, we will use a T test. If there is a wide difference between the average values, it's more likely to be significant. In order to identify differences in the two groups' scores, a representative sample must be taken from all of the population. The difference between the means and the variability of the users' time scores can therefore be assessed. The difference between these two methods, which is divided by variability among the groups, is defined as the T test formula. The difference between groups may be bigger if the T score is greater. A T score of, say, 5 means that the groups are five times as different from one another as they are within each other. For the same alpha value of 0.2 as 00.025, for statistical significance in one direction and then 0.025 in the opposite direction, a double tail test is carried out. Therefore, regardless of the direction of the relationship that we have hypothesised, the statistics are equal as we test the possibility in both directions. If a difference of means exists between two groups, the unpaired test will tell us that it is significant for comparing two separate groups of individuals. We're assuming that the unpaired test results will normally be distributed. The figures will come from various groups of people at the bell curve.
A major success is that this device has been tested in a lab environment, giving us far more control over the tasks we have to perform for our users. We were able to measure people's behaviour more accurately in such a tightly controlled setting, compared with the use of field work.

The use of a laboratory setting is problematic as compared to field work in terms of capturing context. We had the possibility of conducting a within group based study, which would allow all participants to have an opportunity to try both screen sizes.This would have led to an experiment with no differences between them. However, as a sign of a representative sample of the UK population, we have decided to accept individual differences.

Payphone Questionnaire Responses:

Payphone Questionnaire (Responses)



Here the qualitative results show that 86.7% of our users believe that there should be more touchless interactions in public spaces.
Furthermore, the quantitative findings showed that the larger the screen size, the faster that users were able to use our touchless payphone, 60% of the time.

Conclusion:

In conclusion, we developed our touchless payphone box to spur the interest in new touchless designs and to find out the popularity of a touchless design, and how it can help individuals with their daily needs. In our design, we tried to implement a range of particular target audiences including disabled and elderly individuals to allow ease of access and a good experience when utilising our design.
To summarise, we found in our autoethnography our target audience and what the best way to design our touchless payphone is through data collection and brainstorming. When we were Prototyping our touchless payphone we tried to implement as many features that would benefit our target audience and also allow a clear and concise experience. Finally, when evaluating our final design we summarised our key findings and data collection with also mentioning 10 heuristics for our design.
Unfortunately during this process we hit a few obstacles. If we could do this project again we would set out to get some field work done as this would allow us to have a deeper insight into our target audience and what features and limitations they may need or want. Our sample size was around 70 people whereas reflecting upon the process of results we decided that ~300 to ~500 would have been more of an appropriate sample size. We found that our sample size for the questionnaire was not a large enough size to reflect the general population's opinion on what improvements and issues they found with our touchless payphone prototype.
When logging the data in our google doc document we had many different files with similar or same names without organisation which limited our ability to find documents quickly. If we were to do this project again we could use a SQL database to more efficiently organise and sort documents, which in return will allow for easier data manipulation and analysis.