Catawiki

Object sumbission process

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Introduction

What to online auctions and AI have in common? Nothing, yet, but in this project we attempted to change this!

In Project 2 Design, executed in the Artifice squad, our team was asked to work on a challenge posed by Catawiki, a company known to be the most-visited curated marketplace in Europe for special objects. This firm is hosting weekly auctions within an online platform for buying and selling special items and collectibles (Catawiki, sd).

In accordance with the mission of the squad of our choice, we were expected to provide an alternative or additional AI experience within the website of Catawiki. But what is artificial intelligence and what could it add to a marketplace? The complex and official definition says it is a wide-ranging branch of computer science concerned with building smart machines capable of performing tasks that typically require human intelligence (Built In, sd). It is easier, however, to understand it by using examples such as self-driving cars, Siri, Alexa and so on. In e-commerce, AI solutions collect vast amounts of data about customers and items and combine it to enhance customer experience. Unique features that may be encountered often are image-based search, voice search or chatbots (Rejman, 2020).

We were offered the option of either taking the buyer or seller experience, and it was up to our team to decide which one to pursue. It was the anticipation of a challenging and more educational road that prompted our decision to take on the challenge about the seller experience. We were motivated during the whole project, because we strive to deliver something to Catawiki that can be useful to them. We don't want to make something easy by doing too little, but also don't want to make something unrealistic. This can be achieved by making good use of the client meetings, sharing our current work and ideas and actively listening to and implementing the client's feedback.

Throughout the semester, our goal was to incorporate AI in the form of image-recognition and auto-filling feature into the auction submission flow. Using the tool of Teachable Machine and an auto-filling feature that was created in a Wizard of Oz manner in our prototype, we display how we attempted to speed up the completion of object submissions and boost the satisfaction of visitors.

Throughout this project, a reflective transformative design process (Hummers & Frens, 2009) was followed, which is a more open and dynamic design process compared to classical design processes. By continuously reflecting critically on the choices made, with our vision in mind, we ensured that the final product contained well-considered design choices. In this report, we will elaborate on all our decisions, which eventually led to our final result.

Design Process
Define

Two Challenges

Our first step was to choose between two Catawiki challenges. Challenge 1 is about the buyers' perspective and in this challenge, it would be our job to help the buyers to find what they love using artificial intelligence. Challenge 2 is about the sellers' perspective and in this challenge, we would have the responsibility of improving the submission user flow with artificial intelligence.
Taking on challenge 2 was our decision as Team E.

Ideation

Now that we had chosen to go with challenge 2, the sellers' perspective, we had to find out exactly what we wanted to change or improve. In one of the first weeks of the project, we had an ideation workshop in which the goal was to find our specific design brief and to find out who our users are. We first made a mind map in which we wrote down what the function of the AI could be in this project, what the pain points from the users are and we made some 'How might we'-questions, they can be seen in Figure 1. We looked at the customer journey map that Catawiki had shared with us, and we found a lot of frustration in the creating and describing part of making a lot, this is shown in Figure 2. The sellers cannot always fill in every question and it is even harder to find the right category for the product the seller is trying to sell. It is frustrating and it makes the seller insecure about their lot and their chances of selling the product. Therefore, we wanted to make it easier for the seller to make a lot.

Figure 1: 'How might we'- questions

Figure 2: Part of customer journey map by Catawiki

Prototyping Workshop

A week later we had a prototyping workshop. In this workshop the goal was to find the context we are going to work with and to make a first prototype. To define our context, we made the practice map shown in Figure 3. In this map we stated the reasons for a seller to use Catawiki, how they achieve these reasons, what they need to achieve these and what the AI could do to help.

Figure 3: Practice Map

Design Process
Define

After defining the context, we started making a first prototype. Because we are working for a website of a company our final prototype is going to be a digital one. We wanted our first prototype to be physical, we wanted to visualize how the AI would work in our concept. First, we had a little brainstorming session about what our concept would look like, and our first ideas were that our concept would have a chatbot that helps the seller to fill in all the questions that are asked in the submission process and to make sure the seller chooses the right category. We wanted to visualize our chatbot in a nice way, and we came up with the idea to make a chatbot out of the already existing Catawiki logo, which can be seen in Figure 4. By using the Catawiki logo our chatbot would fit perfectly in the already existing aesthetics of the Catawiki website. For this first prototype, with which we wanted to visualize the flow of an AI, we made a little box that has all the data in it. The box is connected to a server that is connected to a laptop, which is connected to its screen. Now we can explain that the AI will get its data from a database, that will be sent to a server and now it can be displayed on the laptop of the seller.

One Pager

During our first meeting with Catawiki they advised us to make a one pager. A one pager would help us to make the problem we want to solve a bit more concrete and it would help us to narrow things down. We have to think about if we want to involve all kinds of products or only categorized products. We define categorized products, as products that are mass produced, so most of the time they have a barcode. We also had to think about the kind of user we wanted to design for. These are the kind of things we tackled in the one pager, which can be found in Appendix 1.
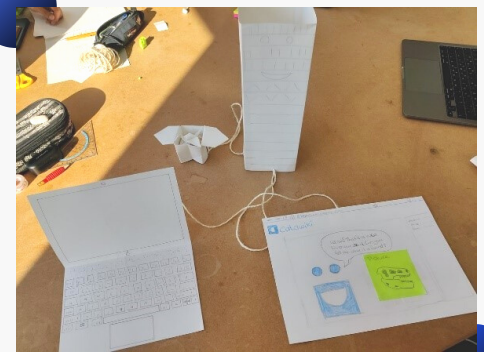

Figure 4: Face of chatbot from logo

First Prototypes
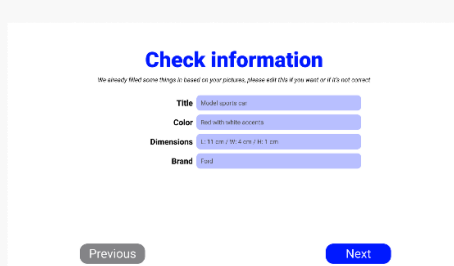

Figure 5: Prototype with chatbot

Figure 6: Prototype without chatbot

We started prototyping and made two different prototypes. The first prototype, shown in Figure 5, includes a chatbot and the second one, shown in Figure 6 does not. The first prototype will start a conversation with the seller to get to know more about what the seller is trying to sell. The chatbot will ask questions as 'Does the product have a barcode?' Or 'Where did you get this product?'. In this way the chatbot will gather information about the product and with that information it can investigate the database and find out if there is already information on this product in there. If so, the AI can already autofill some information. The second prototype does not use a chatbot, but it uses image recognition. The seller uploads some pictures of the product that the seller wants to sell, and it is the job of the AI to recognize what you want to sell and to see if there is already some information about this product in the database. In this way the AI can autofill some information.

Design Process
Define

We discussed these prototypes within our group and we questioned ourselves if we would reach our goal with one of these prototypes. We thought that the chatbot would make the submission process even longer, because the seller has to have a whole conversation with the chatbot, before it can help you. Furthermore, we were wondering if Catawiki itself already considered a chatbot and if so, why did they not implement it. We asked them, and they told us that they did consider a chatbot. The reason why they did not implement this is because they work with a lot of different languages and it would be very hard to implement those all in a chatbot. Also, a chatbot is not something that all sellers like, especially because the average age of the sellers on Catawiki is between 35 and 40 years old.
They also were very impressed by the second prototype and concept, because that is something the Catawiki team is also already working on. They were very curious to see what our final concept will look like and what our findings will be.

Personas

To identify our users, we took a look at the target audience of Catawiki that was shared with us as shown in Figure 7.

With the help of this information, we made two personas. Hanna (Figure 8) and Andrew (Figure 9), they are also displayed at a larger size in Appendix 2. Hanna is a person who is new to selling products on auction websites. She inherited something and she decided to sell this, she does not do this usually. Hanna needs some more guidance through the selling process because she does not know what to expect and what is expected from her. Andrew is a passionate and professional seller. He buys and sells whiskey repeatedly. He does not need a lot of guidance when selling something because he has done it a lot of times already.
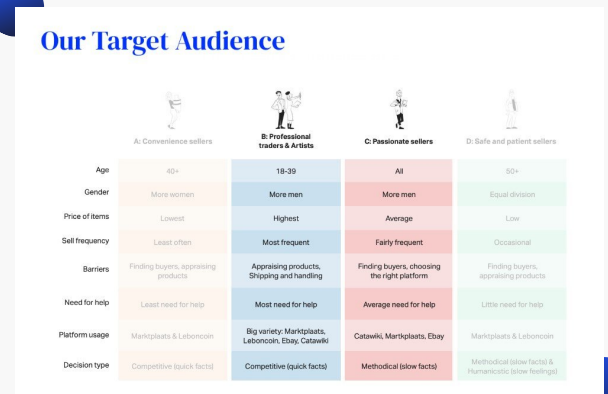

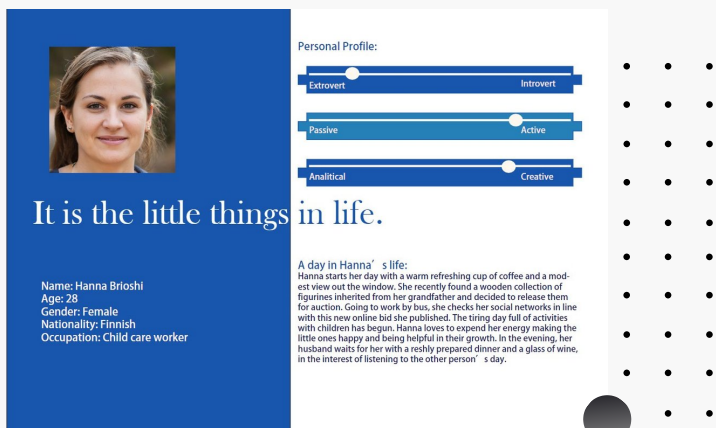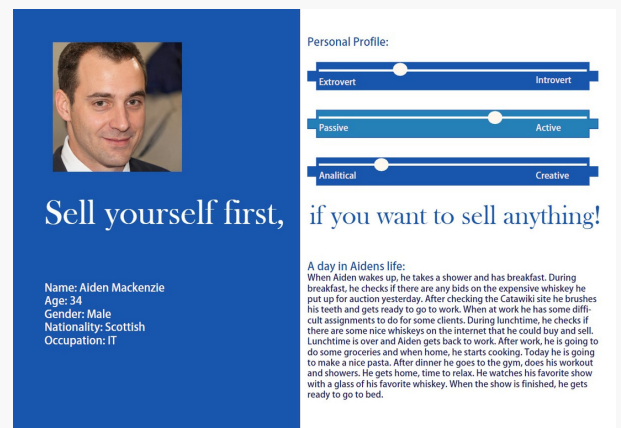Figure 7: Catawiki's target audience (by Catawiki)

Figure 8: Hanna (persona)

Figure 9: Andrew (persona)

Design Process
Define

Teachable Machine

One of our goals was to make a 'working' prototype. Our coaches suggested looking into a teachable machine. This is an AI tool that we can learn how to teach it to recognize different products. We did some research into the Google Teachable Machine and tried this one out ourselves, which is shown in Figure 10. First, with a simple bottle, later in the project we taught the machine to recognize a Nintendo, a LEGO car and a statue. You can teach this machine by giving it a bunch of pictures of one product, from different angles, preferably with a neutral background. You tell the machine what kind of product is in the pictures. From now on the AI can tell you what kind of product you are showing it. If you do this with a lot of products, the AI would be able to distinguish different products.
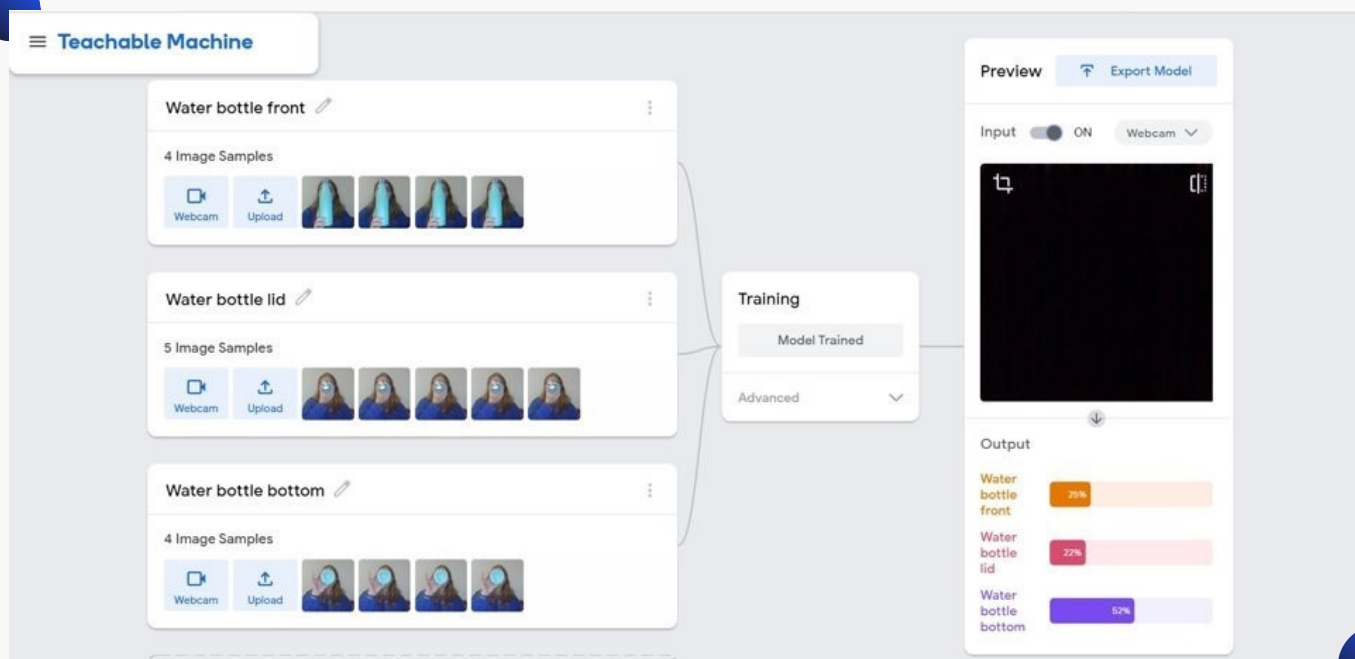

Figure 10: First tests with Teachable Machine

We used the Teachable Machine just for the sake of the prototype. It would not be profitable for Catawiki to use this system because it is impossible to train a model with every product that you can sell on Catawiki. If Catawiki implemented the idea of picture recognition, they would have to make their own artificial intelligence. This would be an AI that is connected to the database of Catawiki, so that it is possible for the AI to compare the pictures of the seller to the pictures that are in the database and in this way it can recognize the product in the picture.

Design Process
Midterm

At this point of our design process, we had at hand three major components to work with in order to conceptualize our idea and prototype for the midterm demo day presentation. These three components include our decision to continue working with our second idea of the prototype (i.e. a process containing image recognition for auto-filling information), two personas of two different probable target users and proof that we have the means to create a prototype that would be functional (using the teachable machine).

The first step towards designing the prototype was to decide how the user interface would function. After experiencing various existing processes of submitting items for sale online we defined two main categories where these processes fall:

- Linear path where information is displayed step by step
  - Pros: Easy to use, self-explanatory, no prior experience required
  - Cons: Makes process longer, lack of general overview of all information for quicker checking and adjustment of answers
- One page where all information can be accessed under different subsections from that one page
  - Pros: Freedom to navigate information as user pleases, all information can be accessed without going backwards
  - Cons: Can be chaotic, steep learning curve to understand the layout of the page

A decisive role in getting out of the dilemma of which category to choose for our prototype played our second above-mentioned component: our two personas. On the one hand, we have a persona who is completely new to the world of selling online and who is in need of an easy and simple environment. On the other hand, we have a user who sells regularly online and is accustomed to such selling processes and who needs a fast and utilitarian environment. It was thus clear that the first category fits the former persona and the second category the latter. Because of that our decision was to develop two processes that include image recognition but with different ways of displaying information, based on the two categories we formed previously.

From then on, our design process is as follows. Creation of one universal, between the two processes, step at the beginning where images are uploaded and analyzed in order to recognize features of the items to be auto-filled later on. Creation of the two processes where information about the auction has to be filled and checked wherever it has already been auto-filled.

More in Depth

- Step 1 - Image recognition (see Figure 11): This step constitutes our main change to the existing Catawiki process regarding artificial intelligence. Currently the process starts with selecting manually a category for the item that has to be sold and then uploading pictures to it. Whereas we had flipped this process by adding the uploading of pictures first. In that way these images can be used by an AI system to find possible information of the item in question. Additionally, we have the AI choose the images with the best quality and recommend and pick those over the ones that do not meet the requirements for use on the site.
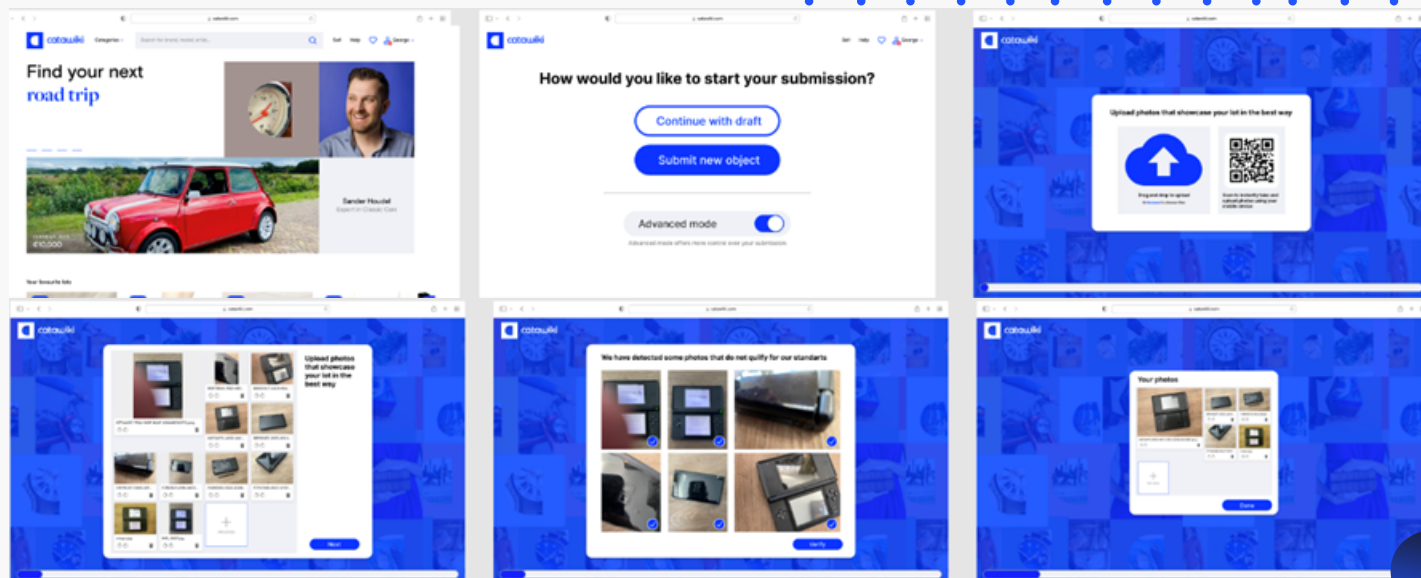
Design Process
Midterm

Figure 11: Image recognition

- Step 2A - Version where all information is shown on one page (see Figure 12): Following the same visual style as the first step, this process was the first we designed out of the two different ones. After the images have been analyzed, the details of the auction have to be filled in. In this version of the process the details are contained in one page under three tabs (category, details, estimated value). On this page, the user can jump between the information and fill in the details in any order. Colour-coded outlines for the answer fields were used to indicate the three different answers given for each detail. Grey indicates that the details have been either filled by the user or it has been auto-filled by the AI using image recognition and it is confident the answer is correct. Yellow indicates the AI has auto-filled a detail but its correctness is uncertain, thus has to be checked and verified by the user. Red indicates that a detail is completely unanswered. Both a cool coded mark on each tab and an overall process bar were added to show the state/percentage of completion for each tab and all the details respectively. Finally, it has to be mentioned that half the page is occupied by the images that had been uploaded earlier in the process.
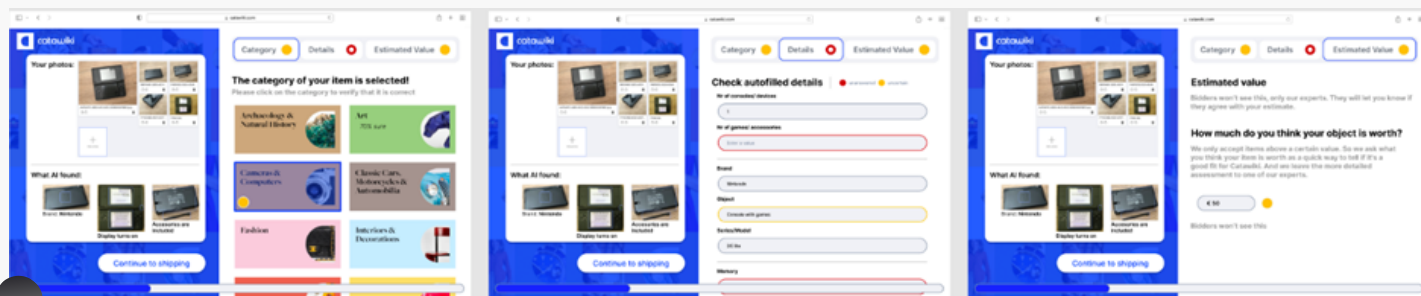

Figure 12: Filling in information for "professional users"

Design Process
Midterm

- Step 2B - Linear process version (see Figure 13): The difference of this process to the first one is that the information contained in the three tabs are spread out to multiple steps. Each step has to be completed before going to the next one. Navigation buttons have been added at the bottom of each step allowing to go to either the next or previous step. The color coding and process bar were carried over to this version as well.
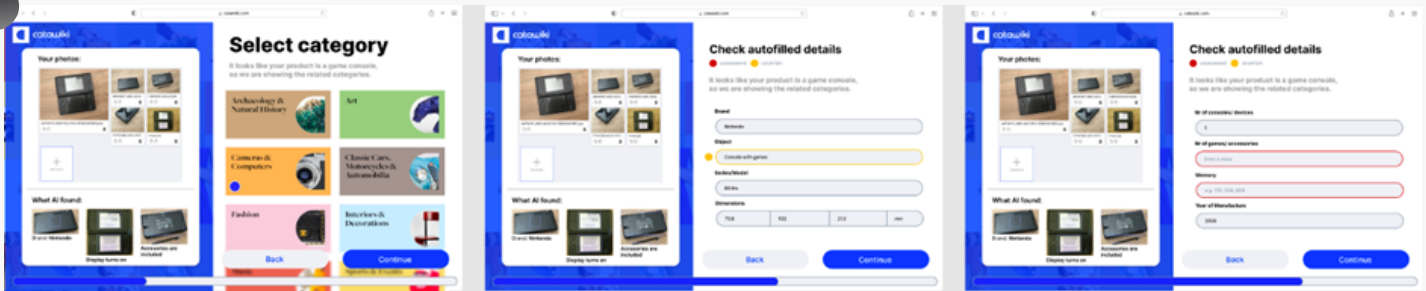

Figure 13: Filling in information for "new users"

The next step after completing the prototypes was to test them. The midterm demo day was the perfect opportunity to get feedback on our prototype. In order to test the two processes we put both in the same prototype. When using the prototype at the beginning the user is presented with the choice to choose between the two processes by activating "advanced mode" to use the one-page process or by deactivating it to use the linear process. In this way we were able to directly compare the two processes while also testing whether it would make sense keeping both processes and making the user decide an easier process or a more practical one based on their needs.
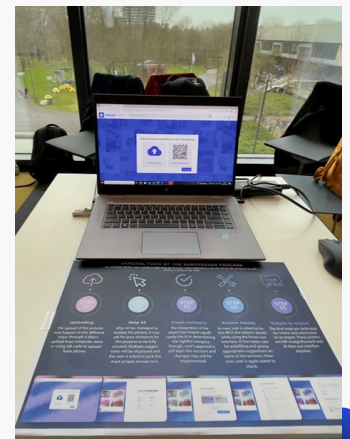

Figure 14: User test setup

Feedback From Midterm

The main feedback received from the Catawiki team was the fact that on their site the variety of items in auction is huge. This means that many of those items are unconventional and rare, something that would mean the image recognition system would not be able to function properly. For that matter further thought has to be put into how our design/method would help the AI recognize objects easier. Other issues that might accrue from our design were also the fact that AI might not understand the difference between two-dimensional objects and three dimensional or difference in size, e.g. a picture of a car and a real car or a real car and a model car respectively. The opinion of the Catawiki team about the two processes was to focus only on one of the two and continue the user tests in order to find which features are better.

One last feedback we got, of high importance, was the suggestion that our design does not offer anything unique to the Catawiki site. The best way to deal with this issue was decided that it was by creating a competitor analysis, which can be found in Appendix 4. For this to be made the method found in the book "A Handbook of Methods" by Tomitsch, M. (2018) was used. The conclusion was that, even though it seemed like the idea of auto filling information via image recognition is commonplace, none of the other main competitors have implemented such a system to their websites. This renders our idea distinctive to the competition making Catawiki's selling process stand out.

Design Process
Final

Following the feedback from the midterm Demoday, it became clear that it is not a good idea to maintain 2 separate user flows for different type of users. It is better to develop a single user flow for all types of users. This way, unnecessary confusion can be prevented and a user does not have to get familiar with the process a second time. Also, it is difficult to draw a line between frequent and infrequent or experienced and inexperienced users.

Summary of Findings From User Tests

We decided to continue our user tests with the two separate midterm prototypes, in order to find out what people like about each specific user flow. The full test setup could be found in the midterm section, but the results will be summarized here. (Tomitsch, 2018) First of all, in both prototypes it was unclear what the colors meant; some people simply ignored them. Also, some people were not familiar with the navigation style in the prototype for "professional users", where the user can go to another page by using the buttons at the top of the page, which is shown in Figure 15. This resulted in people being unaware that these are in fact buttons, perhaps partially due to the fact that these buttons also display information about the actions required on that page.

Figure 15: Navigation style for "professional users"

Based on these findings, we decided to use regular navigation buttons on the bottom of every page, along with a user flow consisting of multiple pages. This also meant we are able to add more explanations to the pages, which is needed to communicate more clearly what the colors mean and what is expected from the user.

There was also room for improvement in the way messages communicated user tasks along the interface. In order to accomplish this mission, some more research on good practices was required. By presenting key messages in the interface, we were able to communicate the essence of what we wanted to say. When writing our new messaging and notification approaches, we aimed for conciseness (maximum of 3 key messages per page screen), relevancy (balancing what to communicate in respect to what users need to know), simplicity (easy-to-understand language; minimal jargon and acronyms) and relatability (active rather than passive voice). (Harrison, 2020)

AI Makes Mistakes

A critical aspect of the feedback we received from the Catawiki staff during the project is that any machine learning algorithm will not always be correct. Catawiki sell a lot of items, ranging from second-hand cataloged products to ancient one-of-a-kind items. Users can sell real cars, model cars or even historical

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Final

pictures of cars, and an AI will not always be capable of telling the difference. So in this new prototype, we needed to make sure that the user can always give feedback to the AI or change its answers in a non-obtrusive way, to prevent any frustrations when the AI is wrong.

This can already be seen in the prototype we have, because the user can always modify a pre-filled input field. However, one important possibility has been neglected so far: What if the AI classifies the object completely incorrectly, and places it in the wrong category? Sure, the user could already change the category if it is not correct, but this might take too much effort resulting in the user dropping out and selling their object elsewhere.

For this reason, we decided to add a question before the AI selects a category. This question, shown in Figure 16, will show 3 possible objects the AI has identified, along with the certainty it has in a percentage. The user has to select one of these items, but also has the possibility to type in another answer. For example, if the user tries to sell a model car, but the AI recognizes it as a real car, the user can easily correct the AI before it will select a category. In our view, this approach is not intrusive and a helpful way of improving the AI's performance. By doing this, the user is also introducing AI to himself/herself, since all they have done so far is upload some images.
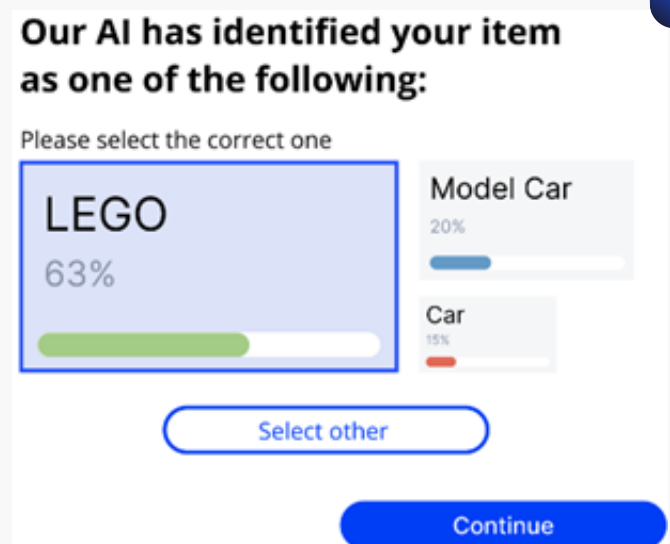
Figure 16: First question

Using Real AI in Prototype

While starting on the creation of a new prototype, we simultaneously started looking into the possibilities for the final Demoday. More specifically, our goal was to integrate Google's Teachable Machine into the prototype, so we started looking into how to achieve this. We quickly found that our best option was to host the Teachable Machine model on Google's servers, while using their provided JavaScript code to make a working page in HTML. However, this code was written to be used with a webcam, which is something we did not want in our prototype. Instead, we wanted to upload a file to the prototype, which would then be processed by the Teachable Machine model we trained.

This meant we had to adapt this JavaScript code in order to work with a file upload button instead of a webcam, by changing some lines of code but most of all writing some new code ourselves. With the use of the internet and with the help of an experienced web developer, we managed to integrate the Teachable Machine successfully into a custom HTML page.

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Final


```
const flip = true; // whether to flip the webcam
webcam = new tmImage.Webcam(200, 200, flip); // width, height, flip
await webcam.setup(); // request access to the webcam
await webcam.play();
window.requestAnimationFrame(loop);

// append elements to the DOM
document.getElementById("webcam-container").appendChild(webcam.canvas);
labelContainer = document.getElementById("label-container");
for (let i = 0; i < maxPredictions; i++) { // and class labels
    labelContainer.appendChild(document.createElement("div"));
}
}

async function loop() {
    webcam.update(); // update the webcam frame
    await predict();
    window.requestAnimationFrame(loop);
}

// run the webcam image through the image model
async function predict() {
    // predict can take in an image, video or canvas html element
    const prediction = await model.predict(webcam.canvas);
    for (let i = 0; i < maxPredictions; i++) {
        const classPrediction =
            prediction[i].className + ": " + prediction[i].probability.toFixed(2)
        labelContainer.childNodes[i].innerHTML = classPrediction;
    }
}
}
</script>
```

Figure 17: JavaScript code provided on Teachable Machine
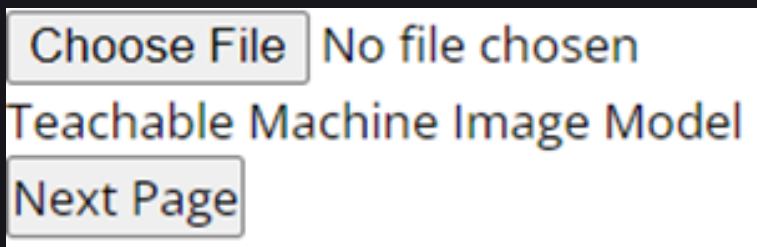
Figure 18: HTML elements provided on Teachable Machine

On the website of Teachable Machine, some HTML and JavaScript code is shared. A part of this is shown in Figure 17.

The HTML is very limited, only a title, a button to start the webcam, a place where the webcam image will be shown and a place to show the results of the model.

The JavaScript code is meant to make sure the model works, and it is a lot longer. By default, it is written to use the webcam image and show the result depending on what is visible in the webcam. In order to make it work with a file upload, all code needed for a webcam was removed and new JavaScript code was written to display the image after is was uploaded. The existing code from Teachable Machine was then adapted to load the image which is being displayed, and let the model run only once with that image. Additionally, a variable was created to make sure the "Next Page" button opens an HTML page with the same name as the class with a certainty of over 70%.

After this worked, the HTML code was rewritten together with CSS code, in order to make it look professional and as if it was a part of Catawiki. The result of this can be seen in Figure 19.

Decisions Regarding Final Prototype

At this point, we had to decide between creating the rest of the prototype in HTML too, or figuring out how to integrate a Figma prototype into our HTML prototype. Figma does allow to add the prototype to HTML using iframe, but we would still be limited by Figma's limitations. The most important limitation when using Figma is the lack of working input fields, we would not able to allow the user to type something into an input field. Additionally, if we would use Figma for the remainder of the prototype, we would have to deal with significant loading times of a part of the page halfway through the user flow. However, the biggest advantage of using Figma is the speed at which a prototype can be created. It would take too much time to program everything in HTML, which is why we quickly decided to combine Figma and HTML for the final Demoday and the pre-Demoday before that.
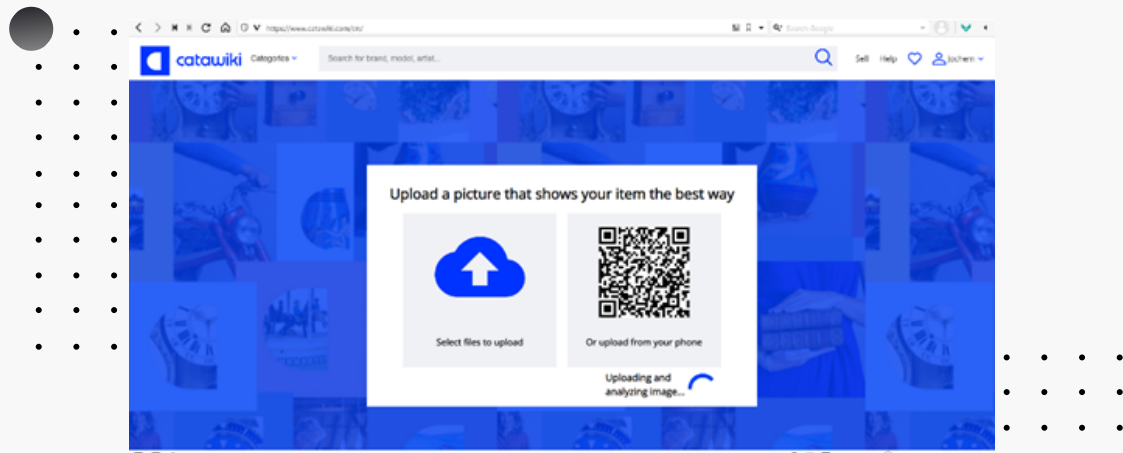
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Figure 19: Final look of webpage with Teachable Machine

Figure 20: Scaling options in Figma

```
iframe.figma-prototype {
    width: 60%;
    border: none;
    position: absolute;
    bottom: 0;
    right: 0;
}
```
Figure 21: CSS code to set the width

Figma has four different options for the scaling of a prototype, which are shown in Figure 20.

In our case, the option to scale the prototype down depending on the width of the page was exactly what we needed. If the page is taller than the screen, the user has to scroll like normal. Additionally, Figma provides the option to load a prototype inside a webpage using a basic HTML feature: iframe. This can be seen in Figure 22. We used this to show the Figma prototype inside our HTML prototype, at a width of 60% of the page. The CSS code used for this is shown in Figure 21.

The remaining width is used by the images of the product, which can be seen in the Overall Results chapter. Another nice feature is that this allows us to make the prototype usable on different screensizes as well, because the Figma prototype will be displayed at full width when the browser window has a width of less than 768 pixels, which is also the case for smaller devices..

```
<iframe class="figma-prototype" src="https://www.figma.com/embed?embed_host=share&
</iframe>
```
Figure 22: The HTML code to add the Figma prototype in an iframe

13.

Design Process
Final

During the pre-Demoday, we let other squad members as well as teachers try out our prototype. In observing them interacting with the prototype, we found that it was still somewhat confusing, mainly because of the colors not being described well enough. Also, we received a lot of useful feedback from the teachers as well as some students, which we combined with our observations from that day to create a new and better prototype. Aside from fixing some spelling mistakes, we played around with sizes to indicate certainty, especially at the question where the user selects the most fitting object.

Additionally, we decided to make the instructions much more clear by showing them on a separate screen, so the user cannot scroll past it. In the HTML code, some minor changes were made to make sure nothing clips into each other and a loading animation was added when uploading and analyzing a picture. Also, for the final Demoday we made sure the user could take a picture themselves of one of the objects we brought, making the whole prototype a lot more interactive. For this, the only thing we needed to figure out was how to quickly transfer the image from a smartphone to the computer. After testing some different methods, we decided to connect the smartphone to the computer with a USB cable as shown in Figure 23, so the photos on the device could easily be accessed with the default file explorer on Windows.

Figure 23: Our Demoday-setup with a smartphone as camera

Overall Results

Final concept:

An AI created by or for Catawiki will be connected to a database with images of previous lots and product information. The submission process will be adapted to include the AI, meaning the first step for the user will be to upload images. The AI will then analyze these images, by attempting to recognize the item and comparing the images with existing images in the database. This will be used to predict the product information, which will be auto-filled for the user if it is above a specific percentage of certainty. The user will be tasked with verifying the auto-filled information and filling in the remaining information. Any input of the user will be stored in a database, which can be used by the AI to improve its accuracy over time.

Step 1: Uploading Images
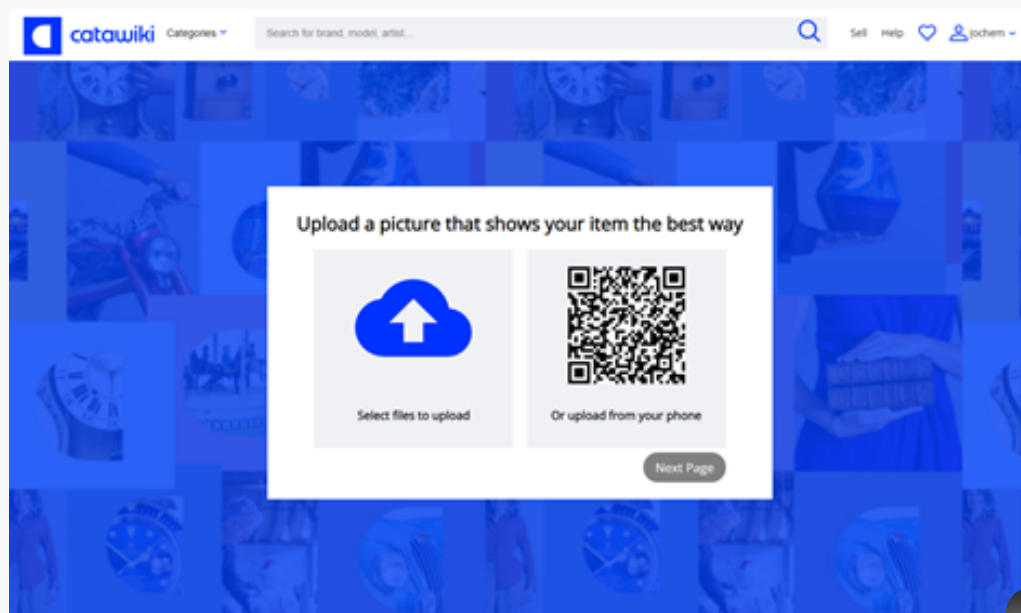
Figure 24: Image uploading page

The very first step in our process, after starting a new lot, is uploading the pictures. This can be done in two ways: The user can upload pictures from their device, or they can scan the QR code to upload existing images from their smartphone or take new pictures and upload them immediately. We don't have a prototype for the screens on the smartphone, but when taking new images, some tips can be displayed to help the user with taking the best possible images. Catawiki could even use an AI to show relevant tips, which could detect problems like unsharp images, an unpleasant white balance or uncentered composition.

Overall Results

Step 2: Define Object
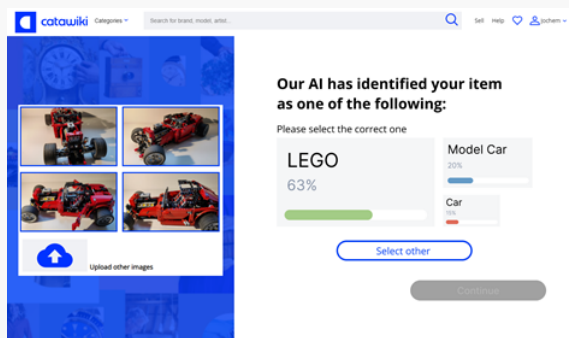
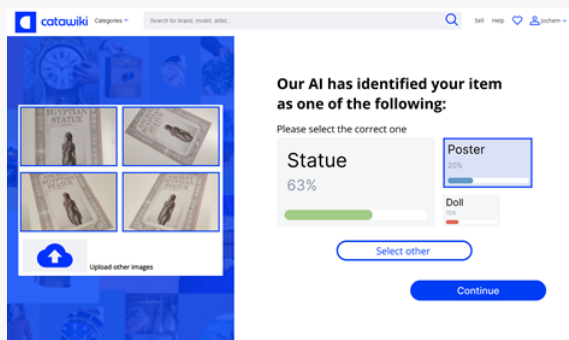*Figure 25: Defining object*

Figure 26: Selected answer

Depending on the object, the second step could be a very important one. In this step, the user will encounter the results from the AI's image processing. If the AI would always be correct, this step would not be necessary. However, an AI will not always be correct, especially in the case of Catawiki's vast amount of products that can be sold. If the AI makes a mistake and recognizes the object as something it is not, the user can easily correct this mistake. Based on the answer given in this step, the AI can determine the category with a much higher certainty. We believe this is a useful step to include, because it does not take much effort from the user and it is better then going through the list of categories to select the right one.

Step 3: Confirm (sub)category

Based on the answer in the previous step, the AI will determine the category it believes is correct. This category will be displayed to the user, who can simply confirm it to continue with their submission. If however the category is wrong, the user is still able to choose the right one from the list of categories that appears when they click "Select other". Also, if the AI is still not certain enough about the category, it could show multiple for the user to choose from, or in the worst case none at all. In that case, the user will have to select the category from the list.

Note that we did not include the subcategory in this prototype. Catawiki can choose where to show this, which could be on this page or the page after.
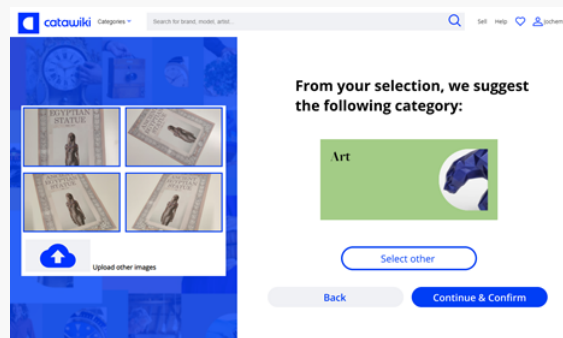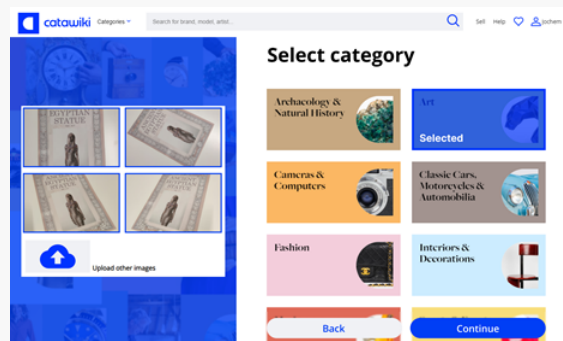

Figure 27: Suggested category

Figure 28: Choosing other category

Overall Results

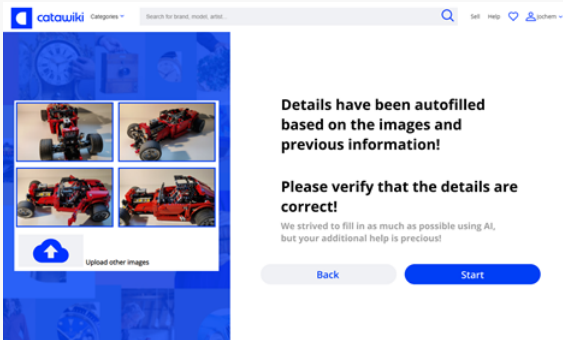## Step 4: Instructions & Entering Information
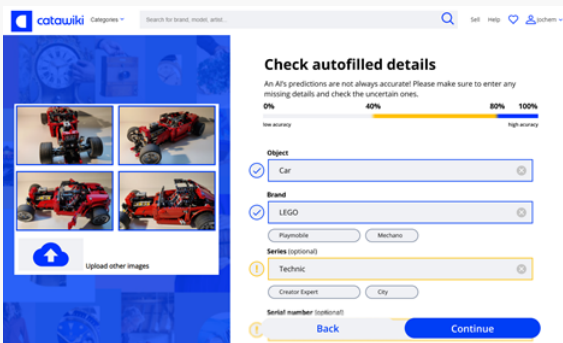

Figure 29: Instructions on separate page

Figure 30: Filling in details

Before filling in the information, the user will receive some instructions on a separate page. This is mainly for users to become aware of the AI and for them to understand that its answers might need to be verified. At the top of the pages with input fields, the meaning of the colors will be displayed: If the AI is above 80% certain about an answer, the field will be outlined in blue and a checkmark icon will be displayed next to it. The user does not have to verify these answers.

If the AI is between 80% and 40% certain about an answer, the field will be outlined in yellow and an exclamation mark icon will be displayed next to it. The user should verify these answers. If they click the field, they can type in a new answer and the outline will change to blue. Even if they do not actually change the answer, it is verified because they clicked it. However, if the user click the "Continue" button while at least one field is still yellow, they will see a popup asking if all answers are correct, but they are able to move on. This might be the case when a user does read the answer, but does not click it to indicate that it is correct.

If the AI is below 40% certain, it will not fill in anything and the user has to fill in the answer manually. Also note that the AI could decide to show multiple options for answers in a small box below the input field, so the user only has to click one of these answers to have it filled in. This could be useful for information like brand, model, material etc.
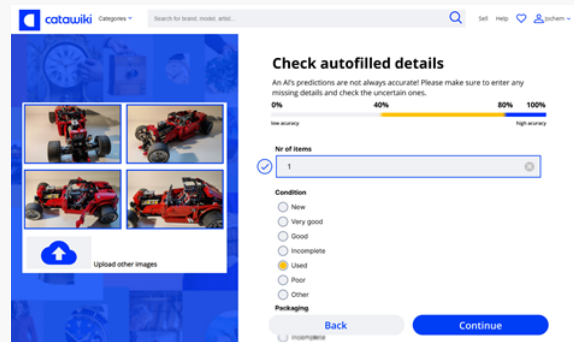
Step 5: Set up lot

Figure 31: Adding information for the buyer

Similarly to the previous step, this page will show auto-filled input fields or multiple choice questions. Where the questions on the previous page are more product-related (brand, material, etc.), the questions on this page are aimed at the lot. This includes information relevant to the buyer, like the condition or whether there is a box. Also, this is a good place for the seller to add a title and description, and set the price estimation.

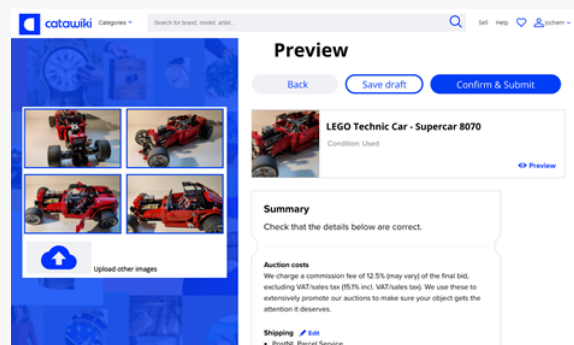## Step 6: Previewing and Submitting

Figure 32: Lot preview

On this page, the auction will be previewed and the user can decide to save it as a draft or submit it to the product expert. This is very similar to the current submission preview on Catawiki, we did not change anything about this.

Overall Results

Other Noteworthy Information

Because the images are an important aspect of our new concept, we decided to always show them on screen when the user is going through the set-up process. In our prototype, we are only showing some uploaded images here and provide the option to upload new ones, however there are some more opportunities with this side bar. First of all, we explored the option to visualize the AI to the user by highlighting certain parts of an image and showing the information the AI gathers from this, this is shown in Figure 33. This might be a nice way to show the user what the AI is doing and how it manages to autofill some information, however it might not work well when most of the information is filled in by comparing the images with a database.
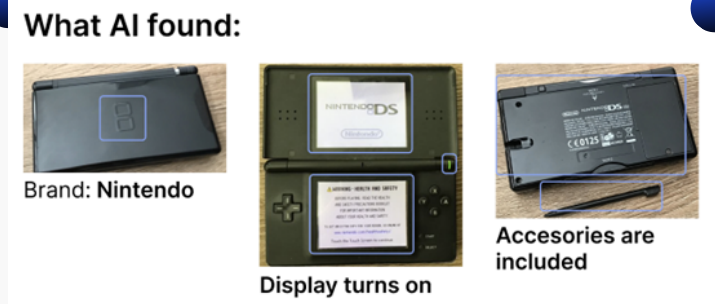

Figure 33: AI highlights

Another option with the potential to enhance the user experience, is showing a preview of the auction in the sidebar while it is being built. So when starting, all there is to see in this preview are the images, but as the user fills in more information, this will be displayed in this preview as well.

Having developed the whole interactive interface, our team focused on summarizing its specifics in a diagram named service blueprint in particular, which is displayed in Figure 34. In fact, Catawiki had its own customer journey map shared with the team for inspiration and usage which contained some of the same information as our service blueprint. In spite of this, our process exhibited multiple distinguishing features that deserve mention. The goal of this visualization is to simplify the task of incorporating future innovations and relevant changes to improve customer satisfaction. All five stages of our new submission process are displayed horizontally on top. The vertical axis of our blueprint presents some of the most remarkable categories that illustrate the main components of the service. Among them are:

- Physical evidence explains what customers come in contact with when moving through stages.
- Customer actions are steps a customer undertakes during the service experience.
- Frontstage actions list the technologies that interact with the user.
- Backstage actions are these preparations and responsibilities that user is unable to see. (Pugh, 2019)
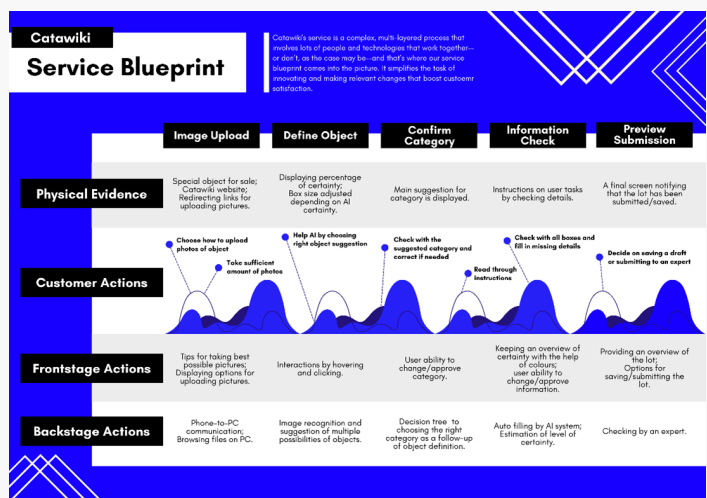
The service blueprint may be viewed at a larger size in Appendix 5.

Figure 34: Service Blueprint

Overall Results

As a way to better explain the design of our interface to the visitors at our final demo day stand, we created a simpler version of the general flow of the process. This can be seen in Figure 35.
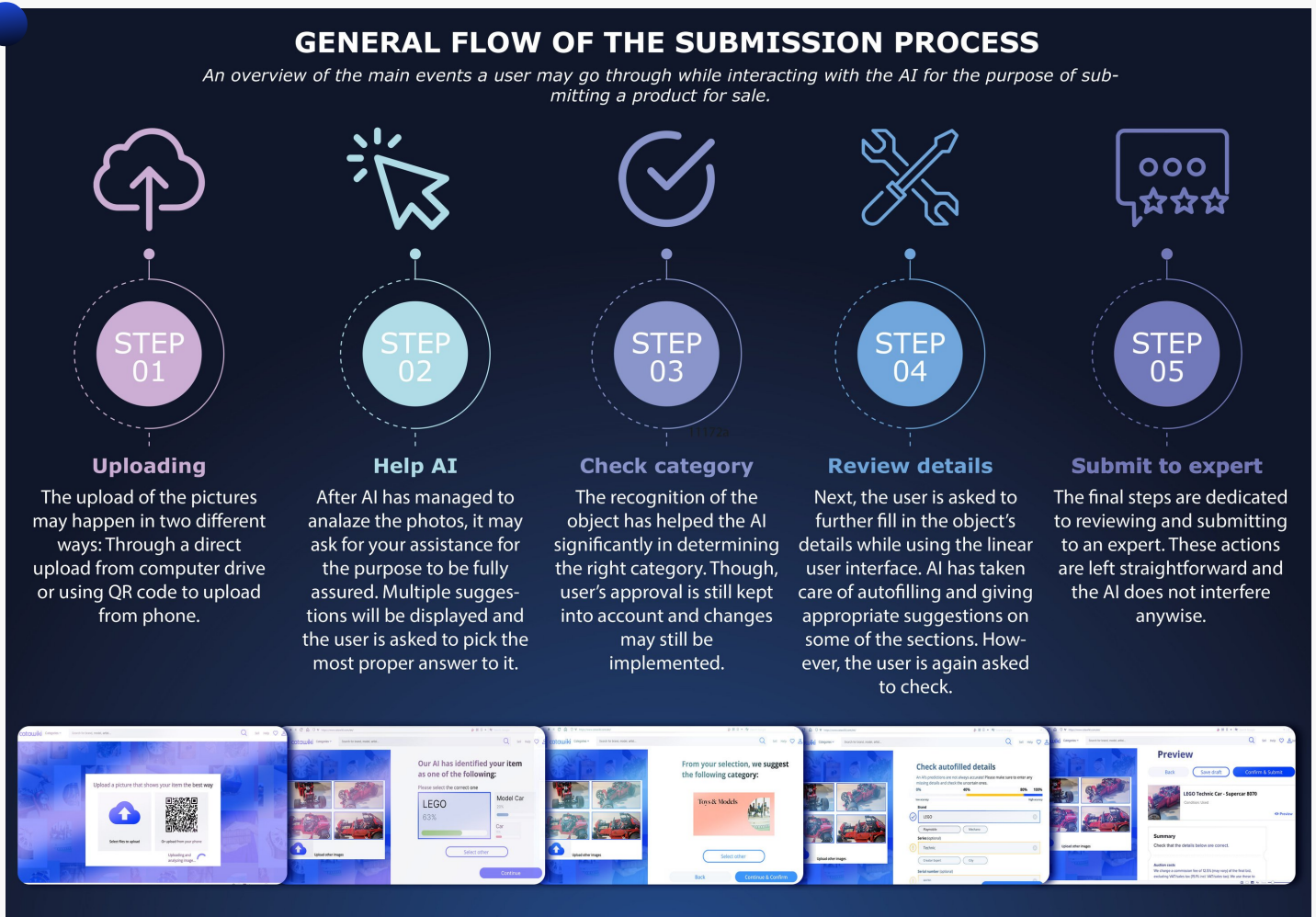The main poster we created can be found in Appendix 6.

Figure 35: Poster explaining the general flow of the submission process

Downloading our Prototype

If you want to try out our prototype yourself, you can download it via the following link: Download Prototype

Because of the NDA, but also because of the university's security settings in OneDrive, you will not be able to download the zip file immediately. Instead, you will see a page where you can request access. Doing so will notify a group member, who can decide if you will be granted access or not. If this link does not work for any reason, which could be the case if you don't have a TU/e account, you can also send an email to j.r.p.verstegen@student.tue.nl, who can then reply to your email with the zip file as an attachment.

Conclusion

Goals and Learning Experiences

Multiple goals that we set were achieved. Firstly, the goal to make a working final prototype is achieved. For now, the prototype only works with the items we used to train the teachable machine model, but in practice would work with every item you teach to the machine. Secondly, the goal of implementing an AI is also achieved. We managed to implement artificial intelligence into our concept and even in our final prototype. The goal of reaching the clients' expectations was also achieved, and while we can not know for sure, we are confident that the client can make use of our work when working on something similar in the future.

During this project, we learned a lot as a group and as individuals. We developed ourselves in the Technology and Realization area by learning about artificial intelligence. What it is and how to work with it. We learned how to implement an AI in our prototype and how to work with different platforms to make such a working prototype.

We also improved our skills in Business and Entrepreneurship, by choosing to work with a client. In this way, we got the opportunity to learn from the client how to communicate with them and how to implement their needs and requirements. Next to that, we developed ourselves in User and Society. We always had to take the user into consideration when designing. We tried to make the best possible concept for the user, by doing user tests and listening to feedback. Additionally, we developed ourselves in Creativity and Aesthetics as well, by closely monitoring the design language Catawiki uses on their website and creating something that would fit in their current design.

Discussion

When the project started, our team got a bit stuck. We did not know what was expected from us and what steps we had to take. After a meeting with our coaches and Catawiki, we had more knowledge of what we had to do, and we could actually start our project. We worked together as a team, and everyone wanted to end up with a nice product for our client. In the end of every meeting, we created a to-do list with all the tasks divided, we set a deadline, and by then, all the tasks should have been finished. Everyone did their tasks and we tried to divide the tasks equally. As a whole, the team worked well together.

It was a team effort, but we were successful in creating a working prototype. For the sake of the prototype, we combined HTML with a Figma prototype. In this way we could visualize our concept in the best way possible. If Catawiki were to implement this, they would have to make their own Artificial intelligence or hire a professional company to do so, for the Teachable Machine is not the right tool because of the vast amount of items that can be sold on Catawiki.

There are a couple of big differences between our concept and the already existing submission flow of Catawiki. Firstly, our concept has an AI that uses picture recognition to recognize what you are trying to sell. With this information, the AI can dig into Catawiki's database and try to fill in the answers to the questions. Secondly, the AI asks for verification of the answers given. It does this in two ways. At first at the beginning

Conclusion

of the submission process, where the AI recognizes the product, the AI displays the answers with percentages and the user must select the right answer. Secondly, when the AI auto-fills answers, the user has to check and verify or edit them. The AI uses colors to indicate its certainty about the answers given. Additionally, the AI stores the answers and images provided by the user to the database, enabling it to become more accurate over time.

If we would have more time to spend on this project, we would do user-tests with what is currently our final prototype, in order to keep developing it further. There will certainly be some things that can be improved, perhaps the instructions could still be not clear enough, the AI might still be too obstructive when it fails, or something else completely. More time would allow for us to find out about potential weaknesses in our design, so we can improve it.

Demoday Feedback

During the Final Demoday, we showed our final concept to our squad, Catawiki and everyone else who was interested. The passersby our stand, shown in Figure 31, could interact with our prototype and give some feedback. Some of the feedback we got is that it was already much better and clearer than our prototype during the Pre-Demoday. Also, because we had some stories beside it and people could make their own pictures and interact with those, it was much clearer what our concept is about. We did notice that still not everyone understood what they had to do with the answers that are colored.

We also got a chance to present our concept to the Catawiki team and they got to give us some feedback on it. They were very impressed with the final prototype, and they were happy with the outcomes. Catawiki is already working on an application that can autofill answers, so our outcomes are very helpful.
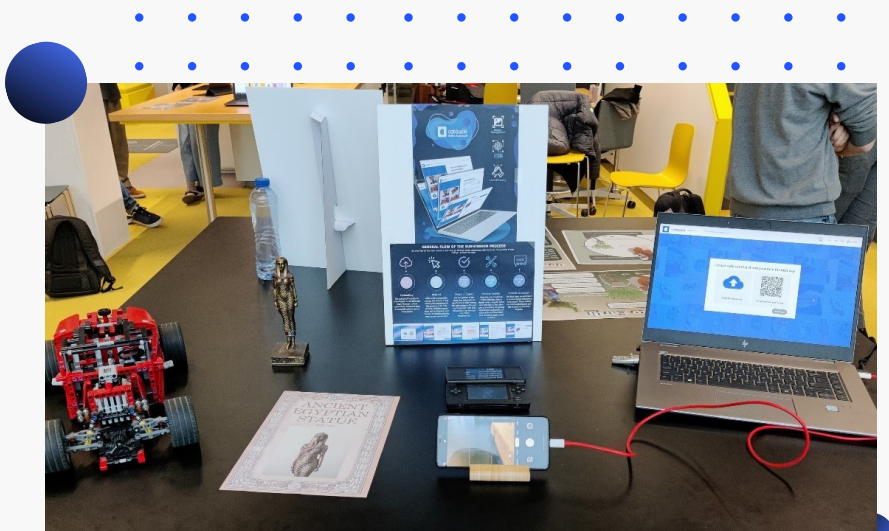

Figure 36 Our stand for the final Demoday

Conclusion

Summary of Effects for Catawiki

By asking us students to design, Catawiki manages to escape from its well-established order, yet sometimes obsolete, and get more creative ideas. Through our solutions, we may be able to support their innovative and out-of-the-box thinking.

Our team came up with a concept that is far from being already shared and used by a wide audience. Yet, it is an attempt to integrate modern technological features that are sought nowadays. Our design provides Catawiki with the ability to envision a new way to ease the selling process by combining multiple AI advances. Since our design is based on interaction, Catawiki may have the possibility of conducting further user testing with it. The design might play a positive role as a basis image for further building up of a working code to the teachable machine and the auto-filling feature. As a result, our design concept and thinking have demonstrated many outcomes that Catawiki can be satisfied with.

Future Steps and What is Still to be Considered

To determine whether a Teachable Machine model will be as effective when more objects are incorporated is an advanced step our team was not able to take due to the time limitations of the project. It would be interesting to see if the AI will still be able to recognize the object fairly accurately and if one screen for defining the object with the client's help will be sufficient for the AI to be certain.

During the final demo day, our last iteration for displaying the AI's certainty by auto-filling did not prove to be intuitively understood by the users. Hence, a usability test might be considered as a future step to grasp the missing piece in the proposed design.

Seeing how real Catawiki users feel about this design is another test our team has agreed to be valuable for any future development. The new design may be contrary to real users' established habits when uploading through Catawiki's website, but the advantages of the new features may outweigh any minor inconvenience of getting used to it.

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Appendix 1

One pager

1. **What problem are you solving? -** You'll have a lot of information on the Miro board shared by Catawiki to find an answer to this. There are currently a lot of problems sellers face during submission but feel free to narrow down to one you think is more crucial.
   a. Resources for this:
   - Customer problem statement template
   - Understanding drop off reasons for passionate and pro sellers

Process of submitting a catalogue products is too long while at the same time it could be shortened. We decide to use AI for that purpose.

1) People do not manage to categorize their object using the search bar or category search. It is an often case that seller will write down what their object exactly is and expect the engine to categorize it itself.

2) Missing interaction and catchy identity expressions while submitting your product.

3) Submitting similar products multiple times might take long time because of the submission process and the bunch of detail that are needed.

2. **Who is this a problem for? -** We have a few different user segments. Since each segment has different needs you might realise that they need different design solutions. While it's great to show a range of solutions that would work for different types of users, it's also perfectly okay to narrow down to one. I'll leave this up to your judgement :)
   a. Resources for this:
   - Types of sellers
   - Our seller's friction points during submission

General user problem, Professional traders and Artists are considered our target group since they are the one using the website most frequently and we would like to help highest percentage of people possible

1) Generally, a seller problem as it is highly dependent on the category search whether your object will make it to the top listings and will be consciously searched for by the buyer. A problem to the Catawiki's employers and employees since customer satisfaction is their main goal. Problem to buyers who are left with little choice at the website because of many sellers dropping out of the procedure.

2),3) Problem of the UI/UX designers and the marketers. Optimizing seller's experience makes this website stand out compared to other similar ones.

3. **What is your design vision to solve this problem? -** This involves analysing the existing landscape (journey maps, problems, HMW's) to come up with a design direction or goal for your team. The vision is essentially the future state of whatever you are redesigning (in this case submission). Since you are already in the ideation phase you might have some directions that you feel strongly about. It might also help to root this vision to one of these - Catawiki's

company goals, an ideal user experience or future tech and design trends that'll help us improve our product.
   a. Resources for this:
   - An interesting read briefly explaining design goals

Our vision is to design a cleaner and easy to use website step process.

1) Include an AI based tool for differentiating between catalogue and not items. Tool able to scan barcodes and have a knowledge base for recognizing the particular product.

2) Include a funny step by step list how to submit your most beautiful shot of the product. Link to partnering website, e.g. Icons 8 Upscaler (better quality photos boosted by AI)

3) AI based tool that shows you similar products description for inspiration based on key words you write down in the description section(similar to Talk to Books by Google)

4. **How would you achieve this vision? -** This is the part where you would get down to the details, diverge and think about how you would design certain parts of the submission journey to achieve the overall vision. *Example, if your vision is to make the submission easy and accessible when the seller is on the move, what are the things you could do to make this possible.*
   a. Resources for this:
   - Crazy eight's to ideate for ideating quick and dirty

5. **Converging** - This is a moment of narrowing down from many ideas to the most appropriate ones. At this stage if you've already scoped your project well with the exact problem, goal and the user, then that should help you discard ideas that don't fit the scope.

Appendix 2

Personas Hanna and Andrew

Personal Profile:

Extrovert ————————————————— Introvert

Passive ————————————————— Active

Analitical ————————————————— Creative

It is the little things in life.

Name: Hanna Brioshi
Age: 28
Gender: Female
Nationality: Finnish
Occupation: Child care worker

A day in Hanna's life:

Hanna starts her day with a warm refreshing cup of coffee and a modest view out the window. She recently found a wooden collection of figurines inherited from her grandfather and decided to release them for auction. Going to work by bus, she checks her social networks in line with this new online bid she published. The tiring day full of activities with children has begun. Hanna loves to expend her energy making the little ones happy and being helpful in their growth. In the evening, her husband waits for her with a reshly prepared dinner and a glass of wine, in the interest of listening to the other person's day.

Personal Profile:

Extrovert ————————————————— Introvert

Passive ————————————————— Active

Analitical ————————————————— Creative

Sell yourself first, if you want to sell anything!

Name: Aiden Mackenzie
Age: 34
Gender: Male
Nationality: Scottish
Occupation: IT
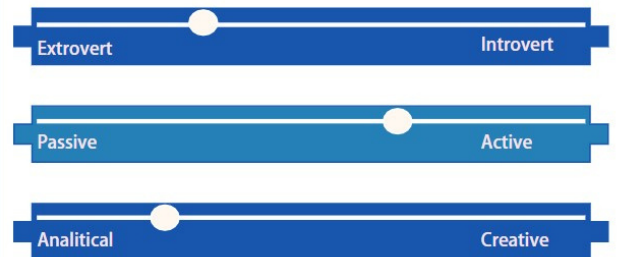
A day in Aidens life:

When Aiden wakes up, he takes a shower and has breakfast. During breakfast, he checks if there are any bids on the expensive whiskey he put up for auction yesterday. After checking the Catawiki site he brushes his teeth and gets ready to go to work. When at work he has some difficult assignments to do for some clients. During lunchtime, he checks if there are some nice whiskeys on the internet that he could buy and sell. Lunchtime is over and Aiden gets back to work. After work, he is going to do some groceries and when home, he starts cooking. Today he is going to make a nice pasta. After dinner he goes to the gym, does his workout and showers. He gets home, time to relax. He watches his favorite show with a glass of his favorite whiskey. When the show is finished, he gets ready to go to bed.

Appendix 3

ERB Form

Page 1

TU/e EINDHOVEN UNIVERSITY OF TECHNOLOGY

Ethical Review Form Education
(Version 17.07.2020)

This Ethical Review Form should be completed for every research study that involves human participants or personally identifiable data. The form should be submitted and approved by your supervisor before potential participants are approached to take part in the research study.

Part 1: General Study Information

1	Student name and email	George Condos, g.condos@student.tue.nl Ember Peters, e.p.f.peters@student.tue.nl Ilia Dichev, i.g.dichev@student.tue.nl, Jochem Verstegen, j.r.p.verstegen@student.tue.nl
2	Supervisor name and email	Yaliang Chuang, y.chuang@tue.nl
3	Degree Program	Industrial Design
4	Bachelor/master	Bachelor
5	Bachelor/master end project?	Bachelor, project 2
6	Course name and code	DFP008 Artifice – Artificial intelligence: aesthetics and ethics
7	Project title	Catawiki: seller submission process
8	Research location	Eindhoven
9	Research period (start/end date)	15/11/21 – 24/11/21
10	[If Applicable] Proposal already approved by (external) Ethical Review Board: Add name, date of approval, and contact details of the ERB	-
11	Research question	Research into people's attitude towards Artificial Intelligence in online market environment and research into their opinion on the suggested interfaces from the group.
12	Description of the research method	Contextual observation – stay next to the user while interacting with the interface for making notes while also performing a think-aloud research method. An online application will come in hand for this purpose, namely Maze. In-depth interview for hearing user feedback and finding more insights on AI implementation. Empathy mapping for further analysis of the gathered data.
13	Description of the research population, in- and exclusion criteria	Gender does not matter; age must be 18 plus as our research group should be able to put items for sale on the Catawiki platform.
14	Number of participants	10 – 20 interviewed people with included in-depth interview and more 40 for filling in the online observational form in order to have a more stable sample of users
15	Explain why the research is socially important.	It is crucial to design user interfaces that are optimized for the user as much as possible. Our research aims to understand the advantages and disadvantages of our ideas related to AI system integration for the existing Catawiki item submission process. There is no possible harm for society.

Page 2

Ethical Review Form

16	Describe the way participants will be recruited	The participants will be acquainted people and they will be contacted personally via phone, message or person to person.
17	Provide a brief statement of the risks you expect for the participants or others involved in the research and explain. Take into consideration any personal data you may gather and privacy issues.	The risk is very minimal. The only personal data we will collect is age and gender. There will be no physical tasks, thus physical risks, for the users aside for using their computer. The tasks are neutral and do not contain any psychological discomfort.

Page 3

Ethical Review Form

Part 2: Checklist for Minimal Risk

		Yes	No
1	Does the study have a medical scientific research question or claim (see definition below)? *Medical/scientific research is research which is carried out with the aim of finding answers to a question in the field of illness and health (etiology, pathogenesis, signs/symptoms, diagnosis, prevention, outcome or treatment of illness), by systematically collecting and analysing data. The research is carried out with the intention of contributing to medical knowledge which can also be applied to populations outside of the direct research population.'*	☐ If yes or maybe: Your supervisor should submit the study to the ERB. You cannot get automatic ethical approval	☒ If no: Continue with question 2
2	Does the study involve human material (such as surgery waste material derived from non-commercial organizations such as hospitals)?	☐ If yes or maybe: This is only allowed if your supervisor has consulted with the medical coordinator. Continue with question 3	☒ If no: Continue with question 3
3	Will the participants give their explicit consent – on a voluntary basis – either digitally or on paper? Or have they given consent in the past for the purpose of education or for re-use in line with the current research question?	☒ If yes: Continue with question 4	☐ If no: Your supervisor should submit the study to the ERB. You cannot get automatic ethical approval
4	Will the study involve discussion or collection of personal data? (e.g. name, address, phone number, email address, IP address, BSN number, location data) or will the study collect and store videos, pictures, or other identifiable data of human subjects?	☐ If yes: The handling, storing and de-identification of the personal data should be discussed with your supervisor. Continue with question 5 if you met all requirements for handling personal data (see …)	☒ If no: Continue with question 5

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Ethical Review Form

		Yes	No
5	Does the study involve participants who are particularly vulnerable or unable to give informed consent? (e.g. children, people with learning difficulties, patients, people receiving counselling, people living in care or nursing homes, people recruited through self-help groups)?	☐ If yes: Your supervisor should submit the study to the ERB. You cannot get automatic ethical approval	☒ If no: Continue with question 6
6	May the research procedure cause harm or discomfort to the participant in any way? (e.g. causing pain or more than mild discomfort, stress, or anxiety)	☐ If yes: Your supervisor should submit the study to the ERB. You cannot get automatic ethical approval	☒ If no: Continue with question 7
7	Will the participants receive any compensation for their participation? Such as a coupon or a chance to win a prize?	☐ If yes: Your supervisor should submit the study to the ERB. You cannot get automatic ethical approval	☒ If no: Continue with question 8 or 10, depending on the type of study (see red text below)

The following questions 8-9 are for *observational* research (e.g. (semi-)structured interviews; focus groups; (participatory) observations). If your research is *experimental*, then skip questions 8-9 and continue with question 10

		Yes	No
8	Will it be necessary for participants to take part in the study without their knowledge and consent at the time? (e.g. covert observation of people)?	☐ If yes: This is only allowed when observing behavior in public space. If so, continue with question 9. If you observe people in non-public space without their consent, your supervisor should submit the study to the ERB. You cannot get automatic ethical approval	☒ If no: Continue with question 9
9	Will participants be asked to discuss or report sexual experiences, religion, alcohol or drug use, or suicidal thoughts, or other topics that are highly personal or intimate?	☐ If yes: Your supervisor should submit the study to the ERB. You cannot get automatic ethical approval	☒ If no: Continue with part 3

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Ethical Review Form

The following questions 10-13 are for *experimental* research (e.g. measurements on yourself or another person; testing a prototype/device; influencing behavior through manipulation (e.g. light or temperature). If your research is *observational*, then skip questions 10-13 and continue with part 3

		Yes	No
10	Is the study invasive (i.e. it affects the body such as puncturing the skin; taking blood or other body material (such as DNA) from the participant)?	☐ If yes: Your supervisor should submit the study to the ERB. You cannot get automatic ethical approval	☐ If no: Continue with question 11
11	Does the device have a medical purpose sucs as diagnosis, prevention, monitoring, prediction, prognosis, treatment or alleviation of disease or injury?	☐ If yes or maybe: Your supervisor should submit the study to the ERB. You cannot get automatic ethical approval	☐ If no: Continue with question 12
12	Will the experiment involve the use of physical devices that are 'CE' certified for unintended use (meaning you will use existing CE certified devices for other things than they were originally intended for?	☐ If yes: This is only allowed if they are completely harmless. They should have a harmless voltage of <5V and hazardous waste (fumes/gas/substances) should not be released. You should discuss with your supervisor whether you need to have the device tested for safety	☐ If no: Continue with question 13
13	Will the experiment involve the use of physical devices that are not 'CE' certified?	☐ If yes: This is only allowed if they are completely harmless. They should have a harmless voltage of <5V and hazardous waste (fumes/gas/substances) should not be released. You should discuss with your supervisor whether you need to have the device tested for safety	☐ If no: Continue with part 3

Page 6

Ethical Review Form

Part 3: Enclosures and Signature

1	Enclosures (tick if applicable): ☒ Informed consent form (link to template); ☒ The survey the participants need to complete, or a description of other measurements (such as interview questions or a description of the prototype); ☐ Text used to find participants (such as brochures, flyers, etc); ☐ Approval other research ethics committee;
2	I hereby declare that I have completed this form truthfully Signature(s) of the student(s) Date

Discuss this form with your supervisor. If any of the boxes your ticked in Part 2 suggest that your supervisor should submit your study to the ERB for ethical approval, try to change your research design in such a way that your supervisor can approve it instead. If this is not possible, ask your supervisor to submit the proposal to the ERB. It will take two to five weeks before you receive a decision from the ERB.

Part 4: Review by supervisor

		Yes	No
1	Does the data storage adhere to all requirements of responsible data management (link toevoegen)?	☒ If yes: Continue with question 2	☐ If no: Discuss with your student the necessary steps to adhere to the requirements
2	Does the research proposal adhere to all requirements for automatic approval?	☒ If yes: Please skip the questions 3-6 and sign the form	☐ If no: Discuss with your student if any alterations can be made in order to adhere to the requirements for automatic approval. If you decide that the study cannot adhere to the requirements, then you as a supervisor need to submit the

Appendix 3

ERB form (continuation)

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Ethical Review Form

		proposal to the ERB. Please answer the following additional questions (3-6)
	Additional questions for ERB approval	
3	Elaborate on the topics from part 2 that do not allow for automatic approval. Describe how you safeguard any potential risk for the research participant for each topic.	
4	Describe and justify the number of participants you need for this research, taking into account the risks and benefits	
5	Explain if your data are completely anonymous, or whether they will be de-identified (pseudonymized or anonymized) and if so, explain how	
6	Who will have access to the data?	

Part 5: Signature by supervisor	
I hereby declare that I have completed this form truthfully Signature of the supervisor Date	

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Ethical Review Form

Information sheet

Purpose of research:
The user test which you are about to take part in has the aim on letting us, the researchers, evaluate the two website interfaces created for our client, namely Catawiki. During the user test, you will be asked for an insight into parts of your demographic background and for trying to use the prototype created by the team. During the interaction with the prototypes, the researchers will arrange a so-called contextual observation with the help of an online platform in order to take notes, record the time, note errors and the amount of clicks that you as a participant will need to complete the tasks given. Moreover, during the observation, you will be asked to participate in the think-aloud research method, in which you need to express descriptively what you are doing at every stage of the process. After this, an in-depth interview will be performed when you will be asked open-ended questions related to your experience with the mock-ups.

Benefits and risks of participation:
Numerous benefits could be extracted from your participation. As first, you will give a feedback which will be from crucial importance for further improvement on the AI integrated into the prototype. Besides, letting your voice be heard could help the great audience that is exposed to AI on everyday basis since your opinion can influence some major changes. There are no rewards associated with your participation, it is considered to be fully voluntary. There are also **no risks** involved in participation.

Procedures for withdrawal from the study:
When withdrawing from the study, all personal data that is collected from a participant will be deleted. The participants can withdraw by contacting one of the researchers at any moment.

Personal information:
For future connection with participants, we ask them to give their name, age and gender. These will be later linked to a participant number when data is being stored, so that privacy is kept. All information will be uploaded to SURFdrive, a cloud storage service licensed by ICTS. The personal information is saved with the purpose of reviewing research results of this user test later.

Participants can at any time contact one of the researchers and request access to and rectification or erasure of personal data. If at any moment in time this research is published, all information about participants will be de-identified.

The retention period of the research data will be the time that it takes to complete the analysis and draw particular conclusions. This time has not been determined yet, however, it is estimated to be a period of one year maximum. After completion of the research and the project, all personal information of participants will be discarded.

When willing to file a complaint, you may contact one of the researchers. A contact person is mentioned at the end page.

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Ethical Review Form

Consent Form
(Catawiki: seller submission process)

Please tick the appropriate boxes   Yes   No

Taking part in the study

	Yes	No
I have read and understood the study information dated [DD/MM/YYYY], or it has been read to me. I have been able to ask questions about the study and my questions have been answered to my satisfaction.	○	○
I consent voluntarily to be a participant in this study and understand that I can refuse to answer questions and I can withdraw from the study at any time, without having to give a reason.	○	○
I understand that taking part in the study involves collection of minimum personal information, contextual observation and interview.	○	○
I understand that taking part in the study involves an observation which is timed by a researcher and where information is recorded by written notes, errors and clicks made.	○	○

Use of the information in the study

	Yes	No
I understand that information I provide will be used for an analysis through an empathy map and for further improvement on the website interface.	○	○
I understand that personal information collected about me that can identify me, such as name, age and gender, will not be shared beyond the study team.	○	○

Future use and reuse of the information by others

	Yes	No
I give permission on the further usage and archive of my personal data and feedback on the prototype so it can be used for future analysis within the scope of this project.	○	○

Signatures

_____   _____   _____
Name of participant [printed]   Signature   Date

I have accurately read out the information sheet to the potential participant and, to the best of my ability, ensured that the participant understands to what they are freely consenting.

_____   _____   _____
Researcher name [printed]   Signature   Date

Study contact details for further information:
- Ilia Dichev, +359887663508, i.g.dichev@student.tue.nl
- George Condos, +306987209872, g.condos@student.tue.nl

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Ethical Review Form

- Jochem Verstegen, +31 6 22290649, j.r.p.verstegen@student.tue.nl
- Ember Peters, +31 6 25584263, e.p.f.peters@student.tue.nl

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Appendix 4

Competitor Analysis

	Catawiki	Ebay	Marktplaats	Sotheby's
Users	Mostly men between 18-39, Professional traders & artists	All	All	People interested in art and luxury
Product Categories	16 categories, with subcategories.	9 categories, with subcategories Very broad	36 categories, very broad	6 categories, with subcategories, mostly luxury
Steps to submit a lot	Long process	Long process	Not very long, you don't have to fill in a lot of details, you can choose yourself which details you fill in.	Quite long, a lot of questions and things you probably have to search for
Help with submitting a lot	Some help where you can click on an info-button, also an expert is going to look at the lot	You enter some features and Ebay 'guesses' what you want to sell. You can click on an info-button.	Marktplaats helps you to find the right category based on the picture you submit. Further no help, autofilling or buttons with more explanation.	When choosing the category you can click a help button to see what the category is about, but there is not a lot of info there. When choosing pictures you get some tips. Further no help, no autofilling, no explanation.
Auction Feeling	You can bid, includes clock. No live auctions.(not in a hurry to buy the object)	On some items you can bid, including a clock. You can also just buy items with a set price.	Little bit, you can bid, but there is no clock	There are live auctions, you can also bid on other items, without a clock. You can also buy items with a set price.
How does the website look	Nice and clean	Doesn't look appealing to me, looks cheap	Clean and clear	Clean, not too clear.

Appendix 5

Service Blueprint
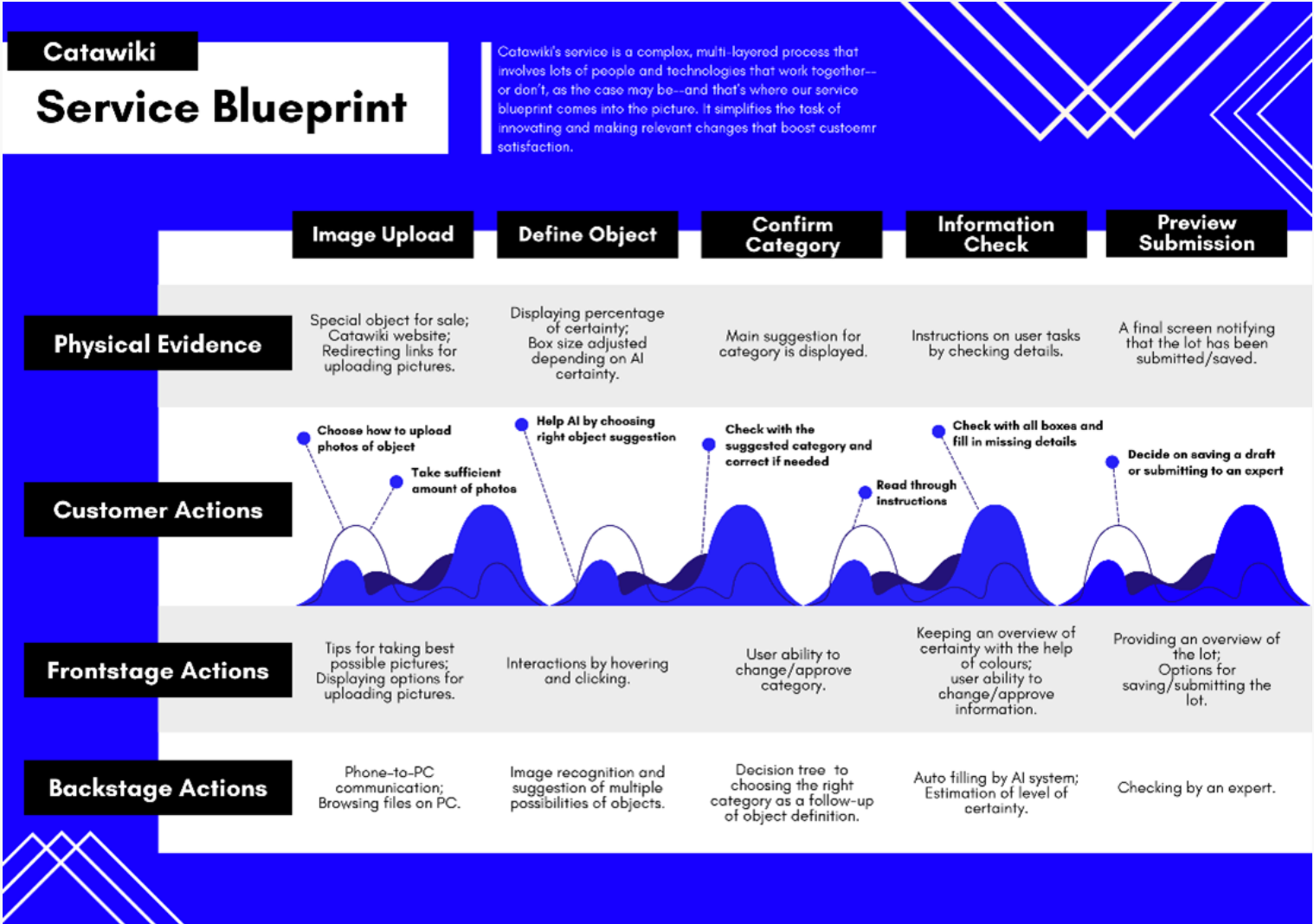
Appendix 6

Demoday Poster