HUMAN COMPUTER INTERACTION AND DESIGN

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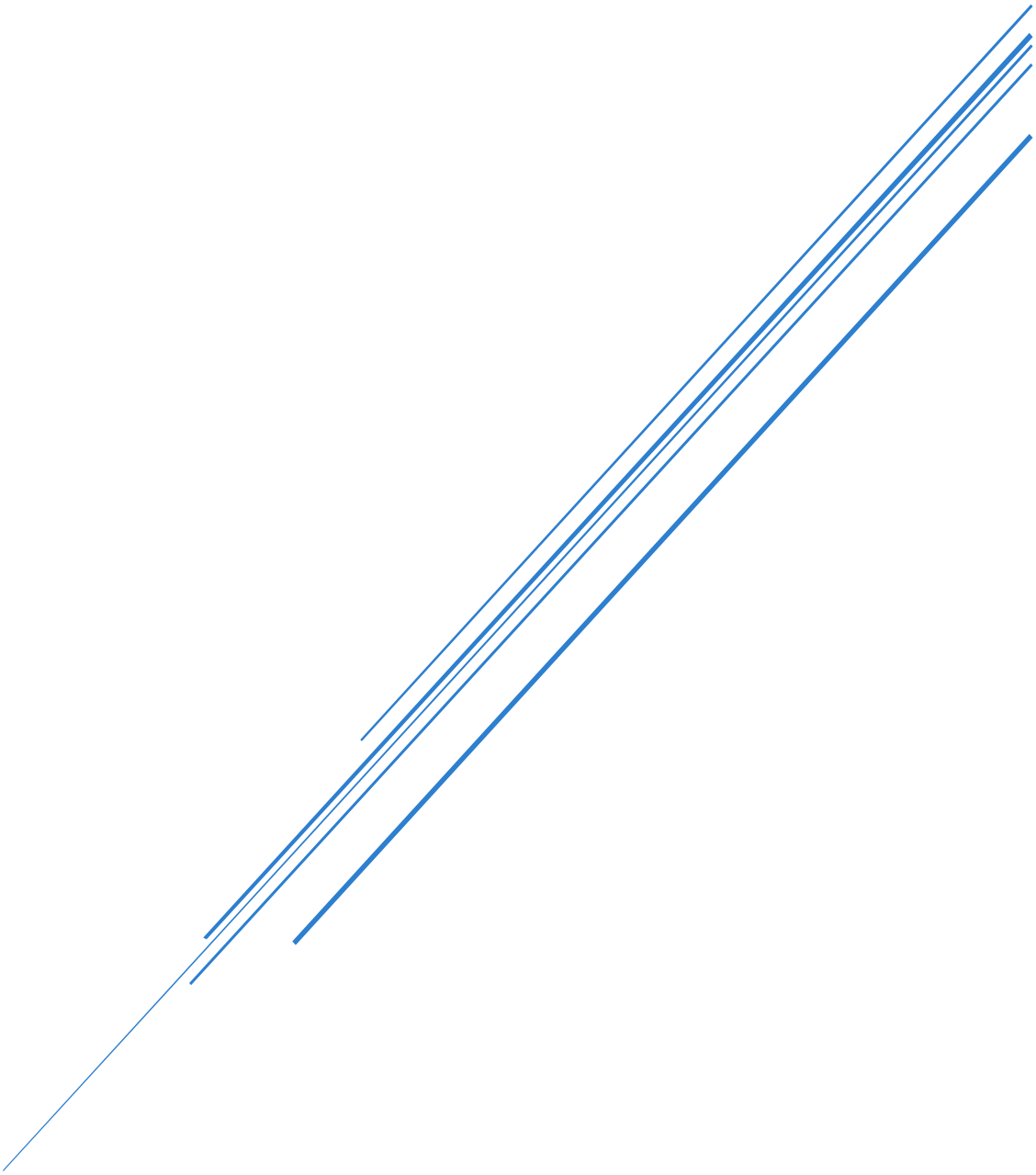

University of Greenwich
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Introduction

In this work, I have been commissioned to create a digital application for children to explore nature, such as animals, plants in the woods and trees.I will investigate my product's design requirements supported by a literature review and future improvements. I aim to identify two to three features in my product and create a proof of concept for the system prototype. My goal is to develop user-friendly features for my target audience. The application should be enjoyable to use, easy to learn and effective.

Background Literature

- ## HCI Research

Research conducted by Ramadhani et al. underlined four main approaches to interaction design. Activity-centred design, System design, Genius design and User-centred design. In this project, I will explore two different methods: user-centred design and activity-centred design.

According to Chammas, Quaresma and Mont'Alvão , User-centred design is based on functional design and usability knowledge to meet user's needs. During the design process, a study is conducted to identify factors related to the context of use. This involves the user's characteristics and physical environment to define the context in which the system is used. A hypothesis about the users' requirements is also produced. (Ramadhani, Mulyanto and Niwanputri, 2020). Based on this research, the design of my application will incorporate age-appropriate visual elements such as appropriate language, images, large buttons and bright colours.

Activity-centred design is defined as a meta-theoretical framework for learning unfamiliar situations. This framework has been adopted in many contexts, such as schools, higher education and vocational education. Activity-centred design is commonly used in contexts where users do not expect to learn anything. Through their participation, they customise and reconfigure aspects of learning situations, becoming autonomous learners (Goodyear, Carvalho and Yeoman, 2021). This approach involves using different techniques, including contextual inquiry, to gather information directly from the users. In this phase, users are observed while performing a task and, at the same time, describe what they are doing. The inquiries are usually performed in a familiar environment to the users. (Think, 2024).

Based on these findings, my application will incorporate interactive features such as a game and reward systems, which will encourage autonomy and problem-solving.

- ## HCI Theory

A book written by Schlichting Mark) provides different insights I can adapt to my design, including practical details of how children's capabilities are adapted to specific design elements.

To develop an excellent product for children, we need to comprehend the value of intrinsic play, the dynamics of attention, and the ways in which the user is continuously engaged. According to research, Nurture-play and Power-play patterns are significant elements to consider in product design. This theory is because children look for ways to express themselves by adopting Make-Believe play. Pretending to be a lion or superhero allows them to adventure power, strength and ability. On the other hand, pretending to be a doctor, mother, or father allows exploration of fostering. I can include Power play in the design of my application by creating activities where

users can feel accomplished and strong, like solving a quest. For example, in tasks like Spot the Hidden Creature, the user will earn badges and unlock more complex challenges if the creature is found. Nurture play can be used for caretaking activities such as feeding animals, planting seeds, watering plants and cutting trees.

Creating invitations

Using bright colours in the design can also grab users' attention. colours can represent a personality or set an aura. According to research this strategy is mostly used by toy makers to attract children in shops or toys stores.

Another aspect mentioned by Schlichting Mark in the book is that we need to create engaging graphics which will provoke the child to perform an action; this is referred to as the "what is that" effect.

Engagement

Comprehension- The first aspect to consider in keeping a child engaged is to create a design that is easy to use. Straightforward and intuitive navigation will increase the child's participation. They will feel successful and able to support their wish to explore.

Instructions- Kids tend to perform actions before listening to instructions; many instructions can prevent them from engaging with the system. We need to keep instructors very basic and minimal.

Humour- Kids are very jovial and love to laugh; interactions with them need to be funny, and this will make them come back and replay their humorous interaction.

(Schlichting Mark, 2019)

Cognitive psychology

According to Donald Arthur Norman's book, there are three levels of Design. The Visceral level produces involuntary immediate responses. These types of designs evoke positive emotions in the consumers. This theory relates to joy as a positive emotion triggered by sensory appeal such as colour, animations and sounds in children's apps. (Donald Arthur Norman 2004)

With these insights, creating relatable scenarios, such as role-play, can build deeper trust between the consumer and the platform.

Another insight from Donald Arthur Norman's book Another insight from Donald Arthur Norman's book, which relates to cognitive psychology, is that appealing products generally make consumers feel good, which makes them more creative and helps them find solutions to problems they encounter.

oy is crucial when it comes to memory retention and exploration; participating in activities that give joy can improve memory performance and significant enthusiasm to make new adventures. This theory indicates that joy can play a part in the exploration of features on a platform, which is important for the children's learning process. (Purnell-Webb, 2024)

Touch screen interactions

Soni et al. produced a framework of touchscreen interaction design recommendations for children's apps.

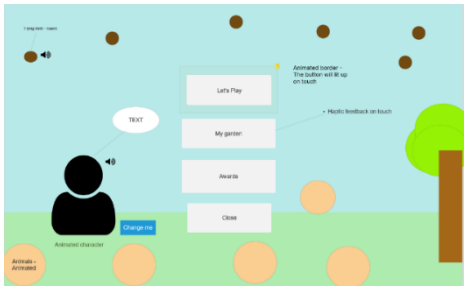
- The study suggests avoiding the need for precise gestures such as pinching or multiple-finger inputs, preventing the user from getting frustrated when trying to solve a desired task.
- Implementing larger buttons and interactive areas can rectify inaccurate touches.

Soni et al. analysed existing applications to review how they comply with the recommendations. Most applications follow the use of bright and vibrant colours and animated characters. On the other hand, many apps require complex touch gestures, which makes the interface unsuitable for children. (Soni et al., 2019)

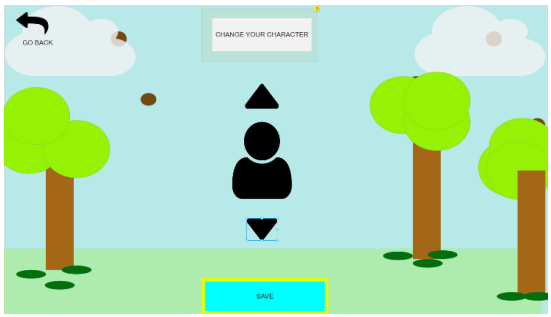
Product Design

Conceptual Design

On this initial screen, the user will be presented with a vibrant and animated menu that includes animal sounds and music. This will ensure the user's interest is captured even without exploring other functionalities of the App. The animated character will present himself as the guide for the adventure; he explains the different activities available and leads the user to the desired activity. The user will be guided with clear and comprehensible instructions, including the speech from the avatar and text on the screen, to avoid confusion and misunderstanding. Children may not be entirely accurate when pressing buttons; for this reason, the buttons will be large enough to prevent any inaccurate touches; this approach complies with Soni et al. design recommendations.

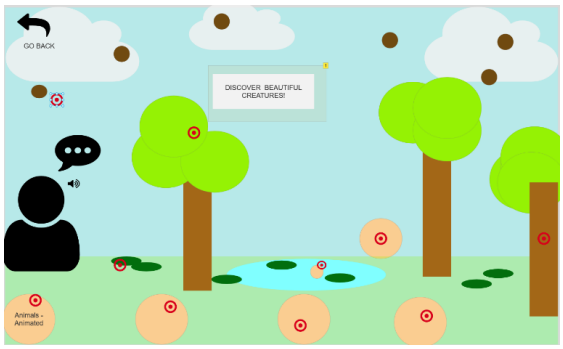


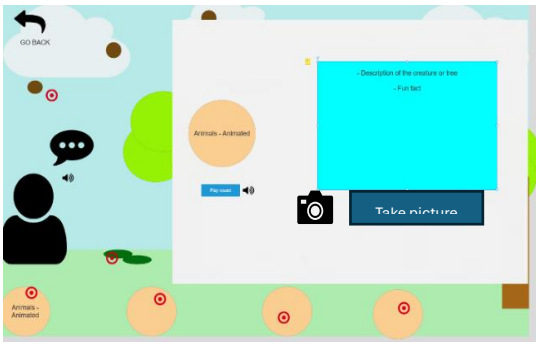
The user will be prompted with an option to change their avatar with a text like “Change me”. This will bring Schlichting Mark ‘s theory about creating a “what is that?” effect into play. My aim is to provoke the user to press on this option and explore what comes with it.



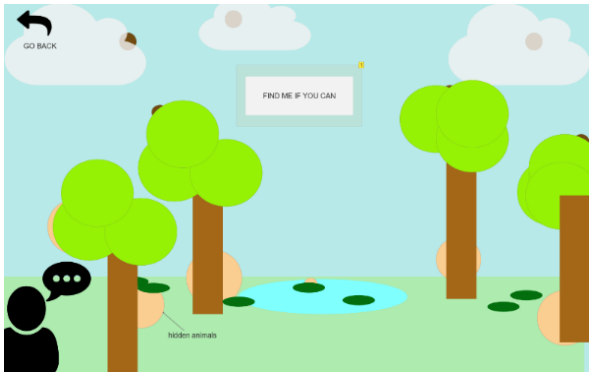
The idea is to make them select a character they visually admire or resemble (superhero, boy, girl) which can relate to the Power-play psychology.

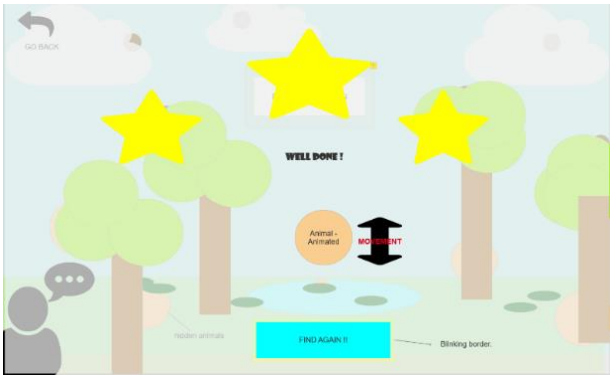
On this screen, the user can touch the red dot on a creature (animals, trees, plants, etc), and a voice description combined with simple text will be exhibited. The description will educate the child by providing a fact about a particular animal or plant (name, sound, spelling, species). It will also contain a fun fact about that creature to make them laugh, for example, "Birds don't have teeth" Once the user has selected the creature to explore, they will be prompted with a camera icon saying "Take Picture" to save a picture of the creature in a gallery.





Users can be entertained on this screen by playing a hidden object game. The avatar will instruct the user to find the hidden creatures, and a successful find will trigger the creature to perform an action. For example, a frog hidden in a pond will jump and make a sound when spotted; the user will be rewarded with stars for every finding based on the difficulty. This design approach can invoke surprise elements discussed in Schlichting Mark's book.

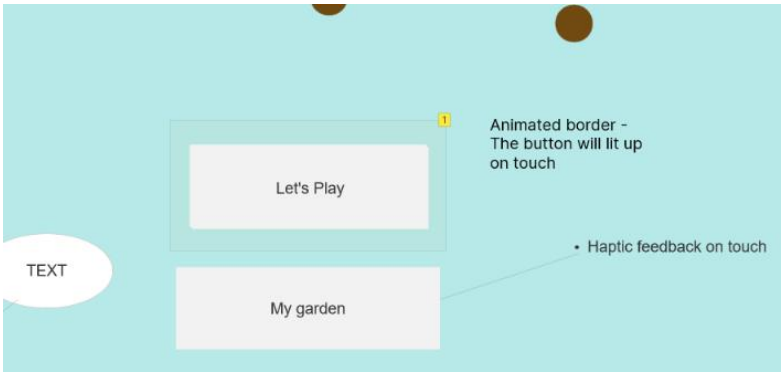




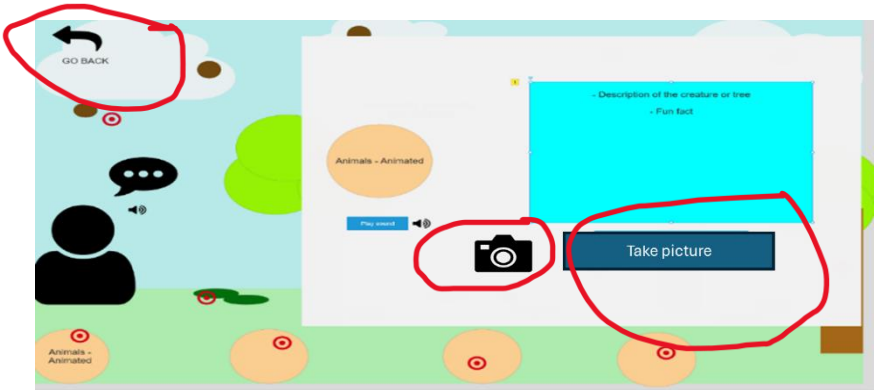
- ## Design principles

  Visibility: The more visible an element is presented, the more likely the user will notice them and use them. On each screen, a noticeable banner prompting the user on what to do is placed at the centre of the user's screen. (Donald Arthur Norman, 2004). This design approach was inspired by Donald Arthur Norman's design principles in his book.

Feedback: Each button will increase in size when pressed, it will also produce a sound when touched and change colour to green with a lit yellow border. This concept will help the user to acknowledge what action has been executed. The buttons will also have haptic feedback, providing a physical feeling when interacting with the device.



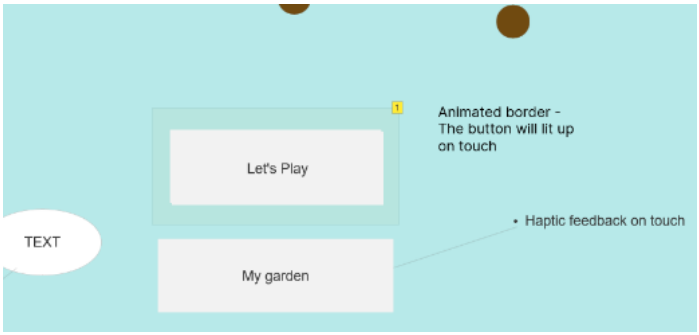
Constraints: The design of my App has been built with constraints in mind; each screen will have clear and few instructions on what to do next. For example, the user will have a button to go back to each screen.



Consistency: Having similar operations and elements throughout the design will ensure easy navigation for the user.

Affordance: This refers to giving a hint on how to use an object; in the design, I have considered using animated borders for each button; this will give a clue to the user that the button needs to be touched.

(Donald Arthur Norman, 2004)

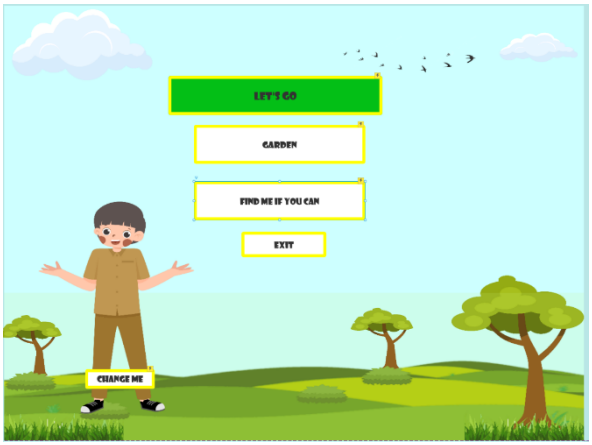


Prototype

Key features

Main Menu

- The App presents itself with a vibrant and dynamic interface featuring an avatar guide. As discussed in this paper, using bright and positive colours will help to get the user's attention and set a positive mood. Using bright colours and animations in the design aligns with Norman's visceral design principles, which create sensory appeal.



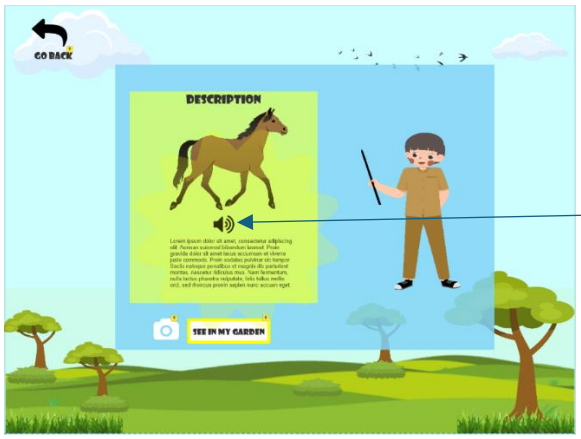
- The interface is presented with clear and simple navigation options, including physical interactions such as touch, scroll, swipe, tactile feedback and sound feedback; I carefully analysed researched design principle to include fewer buttons and interactions in the main menu as it could confuse the user.
- The design includes a feature to change the character in the main menu; the Idea behind this approach is to create a sense of mystery and curiosity in the user. This feature allows users to scroll through different avatars and choose their favourite.
- The interface presents a woodland background; I did not choose a very crowded background because it could distract the user. For example, including many more trees would crowd the interface and create an imbalance between text and images. This minimalistic design complies with User-centred design principles.

“Let’s go” page

- This interface presents the user with a woodland landscape with interactive red dots on animals, some trees, etc. Initially, my approach did not include the red dots. However, I wanted to give the user a hint to touch the dot to see the specific creature.

- Touching the red dot triggers animation and prompts the user with a description, fun facts, and audio clips. Incorporating animations and audio enhances engagement through acoustic and visual feedback.
- A camera icon allows the user to photograph and save the discovery in their "Garden". The camera icon performs a flash animation when touched, this will give a real impression of taking pictures. This interaction with the user also alerts them that an action has been performed, satisfying Don Norman's feedback principle.

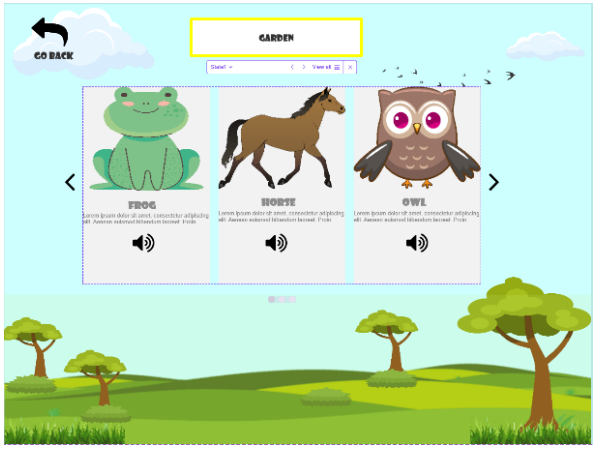
The character appears on the screen to explain what needs to be done.



This icon will produce a sound of the animal when pressed.

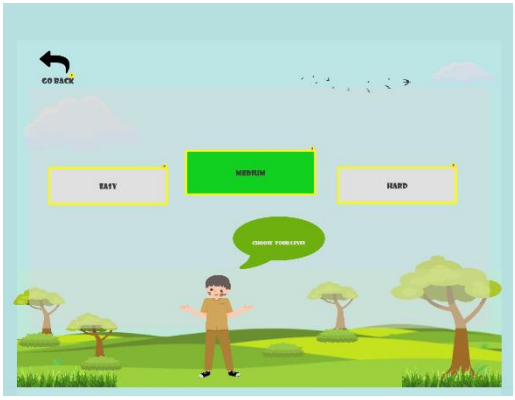
“Garden” Page

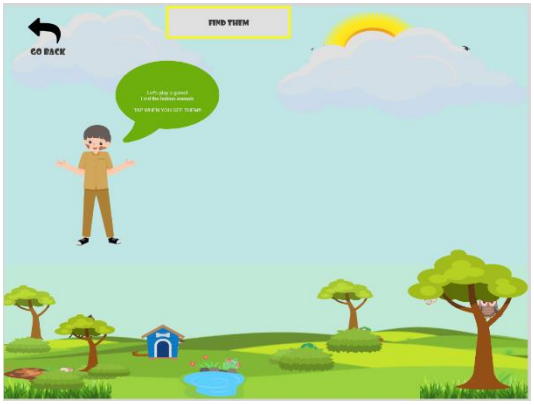
- Users can view discovered creatures in an image carousel by simply swiping left or right, arrows are also available to use in case the user does not understand to use the swiping gesture.

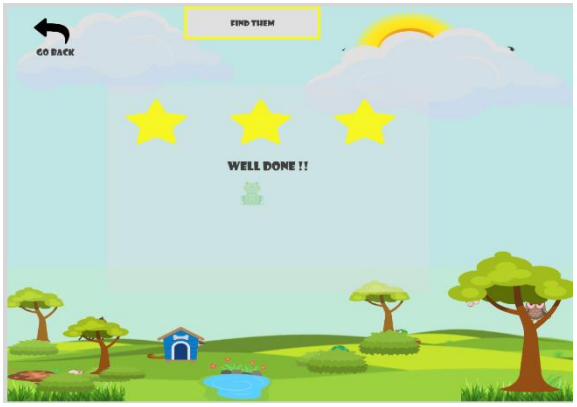


“Find me if you can” page

- The user must find hidden animals in a landscape, when spotted the animals will perform an animation and make a sound for example a frog will jump and croak.
- Upon successive findings the user will be awarded with some stars.
- The interface changes according to the difficulty selected at launch (easy, medium and hard)
- Gamification has been incorporated into the design to motivate and engage users. Stars are assigned after finding the hidden creature.



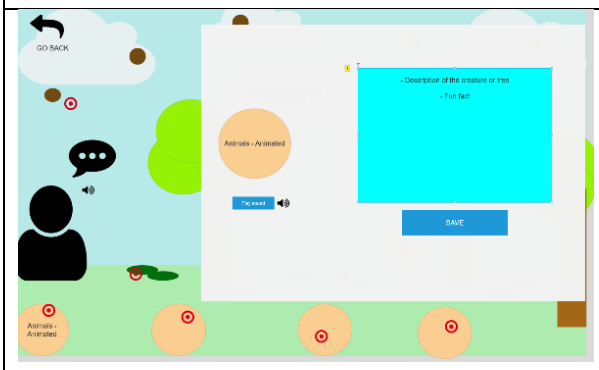
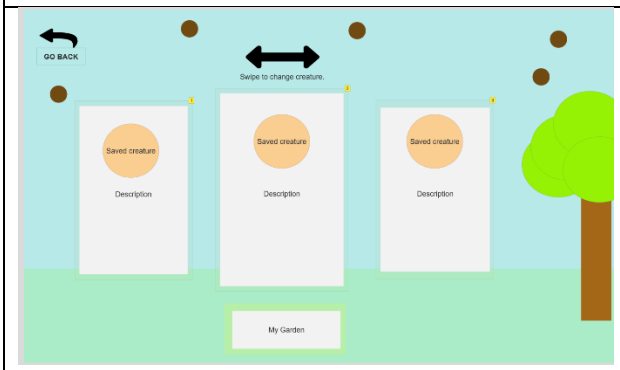
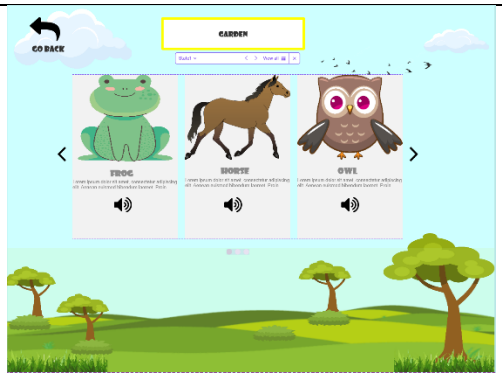


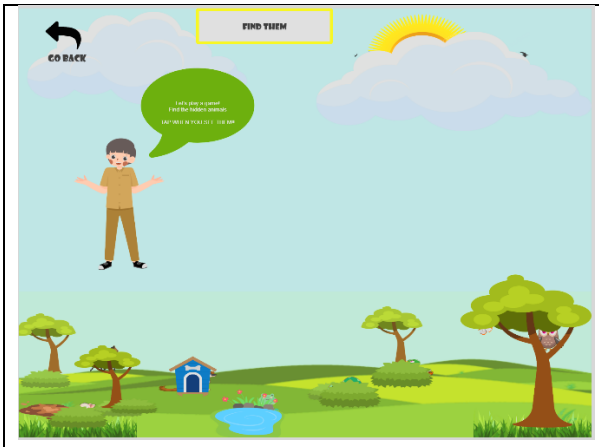
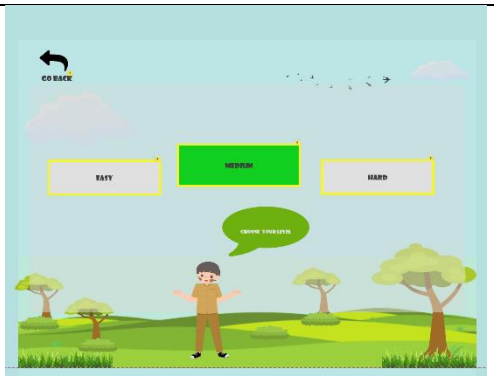
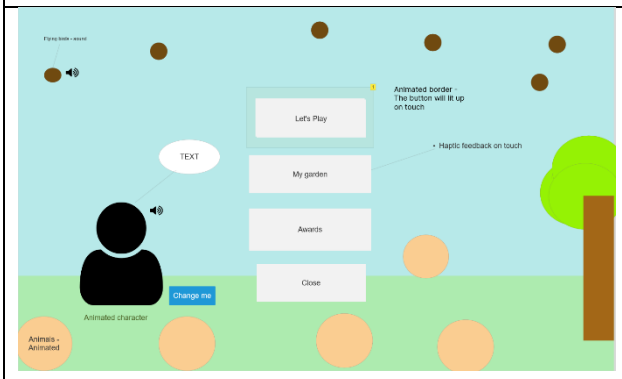
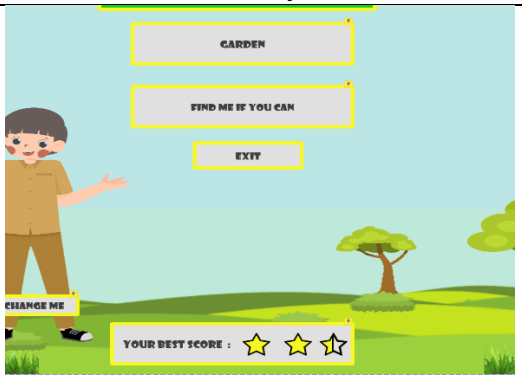


Features implemented in this design were informed by the surprise element theory in Schlichting Mark’s book. Hidden object and unexpected animations create joy and curiosity. Cognitive engagement was another theory I considered, progressive difficulty challenges will maintain the user’s interest.

In conclusion, the features addressed in this section accomplish my design goals. implementing features like avatar customization, animations and games will ensure emotional and cognitive engagement. Audio description, fun facts and exploration tasks will provide an interactive learning experience. Implementing simple gestures commands, intuitive navigation and feedback ensures the app is accessible to children. Lastly, implementing rewards and progressive challenges will inspire children to keep exploring and maintain engagement

Design Process

Initial Concept	Issue	Solution
	The character would not be noticeable in the bottom left corner.	 • Adjusted the position to make the character more noticeable
	The design lacked a clear layout.	 • Adjusted the layout
	The interaction was limited to the swipe gestures. Lacked sound feedback.	 • Added arrows to facilitate navigation • Added sound effects animals

	The design on this page lacked difficulty levels, making the game less engaging	 • Added difficulty selection
	The initial design had a dedicated page for awards. Reducing the number of pages would make the navigation quicker.	 • Added best score on the home page.

Research Study

In this section, I aim to propose a detailed research study to evaluate an assumption in the development of the prototype. The prototype consists of a lively interface to ensure the application entertains and engage children. This study, therefore, investigates whether these features align with user expectations and meet the objectives of user-centred design principles.

Question: Does the prototype effectively engage children in exploring nature and provide the target audience with an enjoyable and easy experience?

Hypothesis:

1. Children using the application will report a high level of satisfaction, engagement and ease of use compared to similar applications.
2. Features such as the find hidden creature rewards system motivate children to feel strong and accomplish and, therefore, explore more challenging adventures.

The study will involve usability testing, observation and a questionnaire to gather insights about the application.

Participants:

The target group is children aged 5- 9 who have basic familiarity with mobile devices and a mix of genders and backgrounds to ensure diversity.

Recruitment plan

- Reach out to local nurseries and primary schools
- Go after the following steps:

STEP	DESCRIPTION	KEY ACTIVITIES
Pre- Study procedure	Preparations before the study starts.	• Prepare the app for testing • Print questionnaires
Introduction	Explain the purpose of the study	• Provide a comprehensive explanation of the study • Ensure that participants understand the study
Exploration	Participants will explore the application with guidance.	• Guide the participants through specific features e.g.: Find me game, • Observe and record usability issues such as confusion, navigation issues and difficulty completing tasks.
Self-exploration	Participants can freely explore the app.	• Allow 15 minutes to explore the app independently. • Observe how they use the App. Record time spent on each task and areas of interest or difficulty.
Feedback (Children)	Gather verbal feedback	• Ask questions to participants on their experience, allow parents to assist in answering if needed.
Questionnaire for parents	Collect parent feedback on the app's features and engagement	• Distribute a short questionnaire to parents to gather their thoughts on the app's engagement, usability and educational potential.

Data Analysis

Responses from the questionnaire will be analysed to observe trends, as well as examine time spent on each feature and the number of successfully completed tasks.
Other analysis will be conducted to identify favourite features and least liked

Conclusion

In conclusion of this project, I'm satisfied with the results obtained, including the HCI research, theory, design principles and the designed prototype. The application of HCI principles and cognitive psychology theories demonstrated how design can be created for a specific audience. The prototype successfully integrates features such as nature exploration, rewards, avatar customisation, creature collection and Hidden creature game. These features were implemented considering HCI principles and theories. The prototype lacks more features and activities. Future improvements can include implementing more interactive features and activities.

One of the constraints of the research was to find accurate and reliable sources. Another limitation I experienced was that assumptions about usability and engagement remain uncertain as the prototype was not tested by an actual user. However, this is due to time and resource limitations.

Overall, this project highlights how thoughtful interaction design can inspire interest and support children's learning.

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Appendices

Post- Study questionnaire for children:

CHILDREN QUESTIONS
1. What was your favourite part of the app? 2. Was anything hard to use 3. would you use this app again

Post- Study questionnaire for parents:

USABILITY
1. How easy was it for your child to interact and navigate with the app ☐ Easy ☐ Neither easy or Difficult ☐ difficult
2. Did your child face any difficulty understanding how to use the app features? ☐ No ☐ Yes **If yes, why** _____
ENGAGEMENT
3. How engaged was your child when using the app ☐ Engaged ☐ Neutral ☐ disengaged
4. Which feature did your child like the most ☐ Nature identification ☐ Hidden object game ☐ Avatar customisation ☐ Rewards
EDUCATIONAL VALUE
5. Do you think the app helped your child to learn about nature? ☐ Yes ☐ Somewhat ☐ No
6. Do you think the content in the app was appropriate for your child? ☐ Yes ☐ Somewhat ☐ No
7. What feature of the app contributed most to your child's learning ☐ Interactive Features ☐ Fun fact, Descriptions ☐ Games and Rewards
SUGGESTIONS
8. Is there any changes or improvement you would like • _____
9. Would you recommend this app to other parents for their children? ☐ **Yes** ☐ **No**

Search Strategy

Database Used

- IEEE Xplore
- ACM Digital Library
- Google Scholar
- Springer Link

Search Terms

- HCI design principles and children applications
- Cognitive psychology and interaction design
- Gamification in children apps

Search Filters

- Reviewed Articles
- Publication 2014-2024
- Language: English