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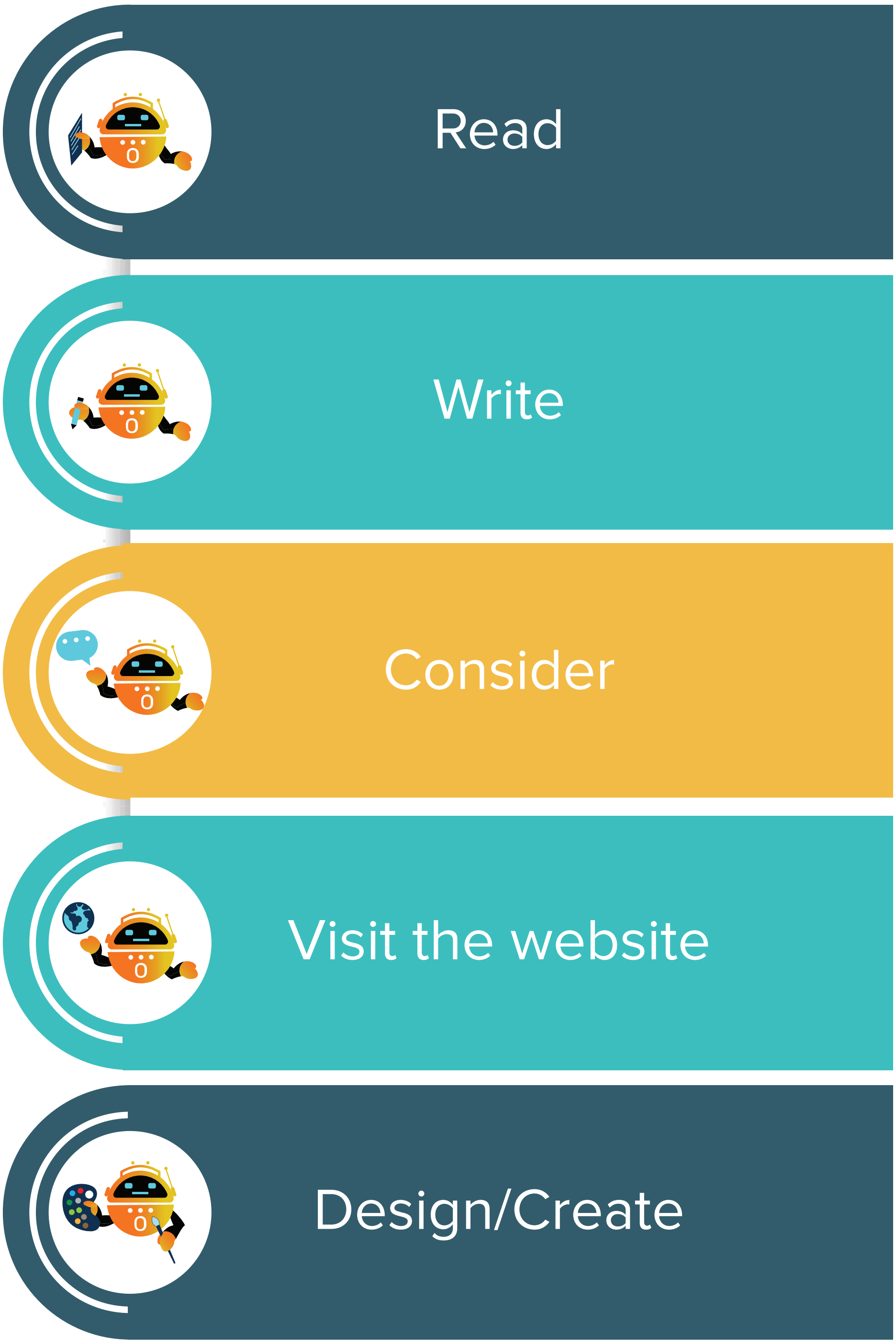
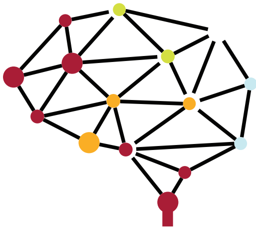
Designing and Building AI Products and Services Workbook

Your AI Mascot will guide you through this week, so watch out for these icons:



Workbook 5: Designing a Human–Computer Interaction Interface



Week 5

Advances in technology have swiftly moved us from keyboard to motion-sensing interactions, bridging the divide between human interaction and computer interaction.

Nevertheless, many interfaces seem to be designed with little regard to usability. This generally leads to frustration, reduced productivity, and lost revenue, as users move on to the next product in their search for new and innovative ways for interaction technology. Therefore, the success of any AI product relies upon incorporating effective user experience design methodologies into the AI design process.

For this task, you'll design a human–computer interface that uses AI to solve a problem or improve a process. Follow the steps below to complete this workbook entry.

1 Step One: Select a Problem

Select a problem that needs to be solved or a process that needs improvement. This problem can be something in your organization or your personal life

For instance, one of Amazon Echo Dot's many capabilities is that it allows a user to select and play music.

In this case, a user desires a hands-free, voice-activated interaction with his/her music playlist.

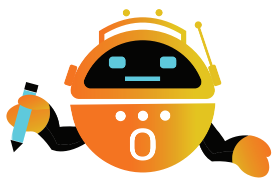
Type your response here

Problem:
Lack of providing customised academic attention to kids.

Description:
As mentioned in my previous assignment, most kids struggle to transition from Primary to High School. This is due to a lack of parents or kids comprehending academically where they stand and not having customised learning solutions.

Though it ' s easy to access all kinds of learning platforms, none(or from my knowledge) provide tailored and engaging learning solutions to kids.

Audience:
Age 9-11 (Year Group 4-6)



2 Step Two: Assess the User

The Interaction Design (IxD) process is what designers use to create solutions centered on users' needs, aims, and behavior when interacting with products.

The IxD process involves five stages:

- Discover what users need/want: Observe and interview potential customers and examine existing solutions
- Analyze: Sort and order your findings
- Design: Outline a potential solution according to design guidelines and fundamental design principles
- Prototype: Give users an idea of what the product will look like and let them test it
- Implement and deploy: Build and launch your product

The IxD process is iterative, and it may take many iterations before pinpointing the ideal version of a solution. So one should continue testing and adapting appropriate changes around an ever-clearer understanding of your users' needs.

You'll tend to find that time and financial constraints get in the way. Examine where you can achieve the most progress by using the most cost-effective techniques to keep your design on course. You should aim for a minimum viable solution rather than wait to release a "perfect" product. Problems are harder to identify than solve, so you should approach assumptions and feedback carefully.

2 Step Two: Assess the User (Cont.)

You can use heuristic evaluation to help you identify the most obvious usability errors and focus on fixing them first. Specifically, for this step, you'll address stage one. This stage involves "finding the users' needs/wants."

Write a paragraph describing how the user and your application's interaction will occur, keeping in mind the user experience and limitations of current human-computer interaction. How can you enhance the user experience with your proposed application?

Consider the following questions in your response:

- Is this a real need or want for the end user?
- How will you go about assessing the user?
    - Will you observe their usage of technology?
    - Will you hold interviews?
    - What other options will you use?
- Which existing solutions will you examine?
- What will you do if the user does view the problem the same way you do?

2 Step Two: Assess the User (Cont.)

Type your response here

As defined in designing Human-Computer Interaction, it involves decisions about Hardware, Interactive Techniques and Applications or Software for User Groups.

Hardware:
The product leverages existing hardware platforms (like Laptops or iPads).

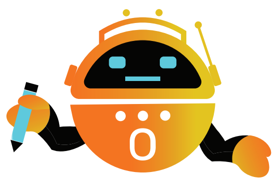
Interactive Techniques:
The successful delivery of the product involves various applications and interfaces through which the user (in this case, kids) interacts with the hardware.

User Requirement:

The main intention of this product is to provide customised solutions to users(here, kids). It involves providing exciting ways to engage them.
For example :
1. Make Kids create their Own Vocabulary List by recording their voices.
2. Embedment of exciting and relevant videos or images while reading books.
3. Learn along with Kids while doing assessments to provide an interactive competitive experience by having the chatbot travel at the pace of Kids.

Measure Customer Experience:

Few of the below business metrics will be collected for measuring customer ’ s satisfaction
1. Frequency of Visits
2. Number of New Subscribers or loss of existing Subscribers (Adds and Churns).
3. Hours spent on a platform
4. Any Feedback via Survey or Ratings
5. Technical Measurements: Latency on Screen Navigation, Input or Output data rendering.



3 Step Three: Select AI application or Algorithm

In this step, given the problem at hand, you need to select the appropriate artificial intelligence algorithm that you will use for the HCI Then, document the alternatives and explain why you selected a particular algorithm for the HCI?

Although it may take a bit of research, the answer to this question is essential for the success of your HCI. Return to the previous weeks' discussions concerning machine learning or deep learning.

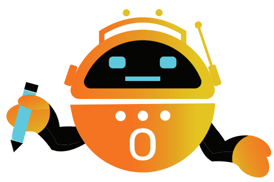
Here are two resources to get you started.

Common Machine Learning Algorithms for Beginners

A machine learning (ML) algorithm is a procedure that runs on data and is used for building a production-ready machine learning model. If you think of machine learning as the train to accomplish a task, then machine learning algorithms are the engines driving the accomplishment of the task.

ML algorithms can be grouped into three main categories.

1. **Supervised machine learning algorithms** search for patterns within the value labels assigned to data points. Some popular machine learning algorithms for supervised learning include SVM for classification problems, linear regression for regression problems, and random forest for regression and classification problems.
2. **Unsupervised machine learning algorithms** work with data where there are no labels associated with data points. These machine learning algorithms organize the data into a group of clusters to describe its structure and make complex data look simple and organized for analysis.



3 Step Three: Select AI application or Algorithm (Cont.)

3. **Reinforcement machine learning algorithms** choose an action based on each data point and later learn how good the decision was. Over time, the algorithm changes its strategy to learn better and achieve the best reward.

Below, we give you a list of some of the most common ML algorithms.

1. **Naïve Bayes classifier algorithm** is among the most popular learning methods grouped by similarities, which works on the popular Bayes theorem of probability. Naïve Bayes classifier algorithm can be used if you have a moderate or large training dataset, if the instances have several attributes, and if, given the classification parameter, attributes that describe the instances should be conditionally independent. Its applications include sentiment analysis, document categorization, and email spam filtering.
2. **K-means clustering algorithm** is a popularly used unsupervised ML algorithm for cluster analysis. The algorithm operates on a given dataset through a predefined number of clusters, k. The output of the k-means algorithm is k clusters with partitioned input data. For instance, let's consider k-means clustering for Wikipedia search results. The search term "Jaguar" on Wikipedia will return all pages containing the word Jaguar which can refer to Jaguar as a car, Jaguar as a Mac OS version, and Jaguar as an animal. K-means clustering algorithm can be applied to group the web pages that talk about similar concepts. It is used by most search engines, such as Yahoo and Google, to cluster web pages by similarity and identify the "relevance rate" of search results.
3. **Support vector machine (SVM) learning algorithm** is a supervised ML algorithm for classification or regression problems where the dataset teaches SVM about classes so that it can classify any new data into different classes by finding a line (hyperplane) which separates the training dataset into classes. The advantages of using SVM include best

classification accuracy on the training data, more efficiency for correct classification of the future data, and no overfitting of the data. SVM is commonly used for stock market forecasting by various financial institutions. For instance, it can be used to compare the relative performance of the stocks when compared to the performance of other stocks in the same sector.

4. **Linear regression machine learning algorithm** shows the relationship between two variables and how the change in one variable impacts the other. Linear regression is used for estimating real continuous values. The most common examples of linear regression are housing price predictions, sales predictions, weather predictions, employee salary estimations, etc. The basic goal of linear regression is to fit the best line among the predictions. Linear regression is one of the most interpretable machine learning algorithms. It's fast and requires minimal tuning.

5. **Logistic regression machine learning algorithm** is used for classification tasks and not regression problems. Here, "regression" implies that a linear model is fit into the feature space. The odds or probabilities that describe the outcome of a single trial are modeled as a function of explanatory variables. Logistic regression algorithms help estimate the probability of falling into a specific level of the categorical dependent variable based on the given predictor variables. Logistic Regression is a robust algorithm as the independent variables need not have equal variance or normal distribution. Additionally, it does not assume a linear relationship between the dependent and independent variables and, hence, can also handle non-linear effects. The applications of logistic regression include epidemiology to identify the risk factors for diseases and plan accordingly for preventive measures as well as for risk management in credit scoring systems.

3 Step Three: Select AI application or Algorithm (Cont.)

6. **Decision tree machine learning algorithm** is a graphical representation that makes use of the branching methodology to exemplify all possible outcomes of a decision, based on certain conditions. In a decision tree, the internal node represents a test on the attribute; each branch of the tree represents the outcome of the test, and the leaf node represents a particular class label, i.e., the decision made after computing all the attributes. The classification rules are represented through the path from the root to the leaf node. Decision trees are very instinctual and can be explained to anyone with ease. People from a non-technical background can also decipher the hypothesis drawn from a decision tree, as they are self-explanatory. Decision tree algorithms can handle both categorical and numerical variables and do not require making any assumption on the linearity in the data. Hence, they can be used in circumstances where the parameters are non-linearly related. These algorithms are useful in data exploration and implicitly perform feature selection. In finance, applications of decision trees include banks classifying loan applicants; in medicine, they are used to identify at-risk patients and disease trends.

7. **Artificial neural networks (ANN) algorithms** have interconnected non-linear neurons; thus, these machine learning algorithms can exploit non-linearity in a distributed manner. They can adapt free parameters to the changes in the surrounding environment. They learn from their mistakes and make better decisions through backpropagation. ANNs are easy to conceptualize, and they can identify all probable interactions between predictor variables. Financial institutions use ANN machine learning algorithms to enhance their performance in evaluating loan applications and bond rating. Many bomb detectors at U.S. airports use artificial neural networks to analyze airborne trace elements and identify the presence of explosive chemicals.

Google uses artificial neural networks for speech recognition, image recognition, and other pattern recognition (handwriting recognition) applications.

8. **K-nearest neighbors (KNN)** uses the prediction of continuous values like regression. Distance-based measures are used in k-nearest neighbors to get the closest correct prediction. The final prediction value is chosen on the basis of the k neighbors. The advantages of using k-nearest neighbors include high accuracy; however, better algorithms exist, and 'it's very useful for non-linear data, as there are no assumptions here.

Understanding the Four Types of Artificial Intelligence

There are four types of artificial intelligence: reactive machines, limited memory, theory of mind, and self-awareness.

Reactive machines: The most basic types of AI systems are purely reactive and don't have the ability to either form memories or use past experiences to inform current decisions. An example of this is Deep Blue, IBM's chess-playing supercomputer, which beat international grandmaster Garry Kasparov in the late 1990s.

Deep Blue can identify the pieces on a chess board and know about each move. It can make predictions about what moves might be next for it and its opponent and can choose the most optimal moves from among the possibilities. But it doesn't have any concept of the past or any memory of what has happened before.

This type of intelligence involves the computer perceiving the world directly and acting on what it sees. It doesn't rely on an internal concept of the world.

3 Step Three: Select AI application or Algorithm (Cont.)

The current intelligent machines we marvel at either have no such concept of the world or have a very limited and specialized one for its duties. The innovation in Deep Blue's design was not to broaden the range of possible moves the computer considered. Rather, the developers found a way to narrow its view, to stop pursuing some potential future moves, based on how it rated their outcome.

These methods do improve the ability of AI systems to play specific games better, but they can't be easily changed or applied to other situations. These computerized imaginations have no concept of the wider world – they can't function beyond the specific tasks they're assigned and are easily fooled.

Limited memory: This type contains machines that can investigate the past. Self-driving cars do some of this already. For example, they observe other cars' speed and direction. That can't be done in just one moment but rather requires identifying specific objects and monitoring them over time.

These observations are added to the self-driving cars' preprogrammed representations of the world, which also include lane markings, traffic lights, and other important elements, such as curves in the road. They're included when the car decides when to change lanes, to avoid cutting off another driver or being hit by a nearby car.

But these simple pieces of information about the past are only transient. They aren't saved as part of the car's library of experience it can learn from, the way human drivers compile experience over years behind the wheel.

Theory of mind: Machines in this class not only form representations about the world but also about other agents or entities in the world. In psychology, this is called "theory of mind" – the understanding that people, creatures, and objects in the world can have thoughts and emotions that affect their own behavior.

Step Three: Select AI application or Algorithm (Cont.)

This is crucial to how we humans formed societies because they allowed us to have social interactions. Without understanding each other's motives and intentions and without considering what somebody else knows either about me or the environment, working together is at best difficult and at worst impossible.

Self-awareness: The final step of AI development is to build systems that can form representations about themselves.

This is, in a sense, an extension of the "the theory of mind" possessed by type III artificial intelligences. Consciousness is also called "self-awareness" for a reason – "I want that item" is a very different statement from "I know I want that item." Conscious beings are aware of themselves and know about their internal states; they can predict others' feelings. We assume someone honking behind us in traffic is angry or impatient, because that's how we feel when we honk at others. Without a theory of mind, we could not make those sorts of inferences.

While we are probably far from creating machines that are self-aware, we should focus our efforts toward understanding memory, learning, and the ability to base decisions on past experiences. This is an important step to understand human intelligence on its own. This is crucial if we want to design or evolve machines that are more than exceptional at classifying what they see in front of them.

3 Step Three: Select AI application or Algorithm (Cont.)

Type your response here

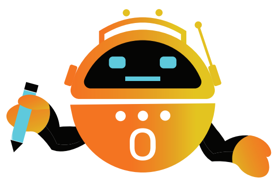
The creation of this AI product involves the composition of many types of AI algorithms and types. The driving of these implementations depends on aimed use cases and user groups.

Use Case 1: Audio/Video/Text Recognitions: Required Deep Learning
This requires handling Multiple Modalities, such as combining Audio and Video techniques to provide real-time Text to Video interactions while reading a novel or book. It involves the usage of Deep Learning Algorithms that can do reverse transformations, for example, converting Text to some format of Imaginary Videos (Similar to the experience provided by Sora Platform).

Use Case 2: Classifications/Recommendations: Required Supervised Classification
This requires identifying specific learning materials or assessments that can best fit the Kids' learning pace. I am not narrowing down to particular algorithms but comparing and selecting appropriate methods that can correctly classify according to Kid's needs. This is a bit tricky, which forms the success of this product.

Use Case 3: ChatBot Experience: Requires NLP or Reinforcement Algorithms
This requires handling computer travel at kids' pace to provide a more interactive and exciting experience. Algorithms that learn according to kids' pace and sometimes take mock tests similar to that kid will offer a considerable advantage to kids. As the kid learns and progresses at every level, we can get the computer to learn and progress and provide User Simulation.

Thanks to all the incredible technologies and progress of these Machine Learning Algorithms.



4 Step Four: Design the Interface

Interaction design focuses on creating engaging interfaces with behaviors that are well thought out. Understanding how users and technology communicate with each other is fundamental to this field. With this understanding, you can anticipate how someone might interact with the system, fix problems early, and invent new ways of doing things.

Best Practices for Designing Interactions

Consider these qualities and the associated questions when creating digital products that have an interactive element.

Define how users can interact with the interface.	• **What can a user do with their mouse, finger, or stylus to directly interact with the interface?** This includes pushing buttons, dragging, and dropping across the interface, etc. • **What commands can a user give that aren't directly a part of the product to interact with it?** An example of an "indirect manipulation" is when a user hits "Ctrl+C," they expect to be able to copy a piece of content
Give users clues about behavior before actions are taken.	• **What about the appearance (color, shape, size, etc.) gives the user a clue about how it may function?**

4 Step Four: Design the Interface (Cont.)

	• **What information do you provide to let a user know what will happen before they perform an action?** This tells users what will happen if they decide to move forward with their action
Anticipate and mitigate errors.	• **Are there constraints put in place to help prevent errors?** • **Do error messages provide a way for the user to correct the problem or explain why the error occurred?**
Consider the system feedback and response time.	• **What feedback does a user get once an action is performed?** When a user engages and performs an action, the system needs to respond to acknowledge the action • **How long does it take between an action and a product's response time?** Responsiveness (latency) can be characterized at four levels: immediate (less than 0.1 second), stammer (0.1–1 second), interruption (1–10 seconds), and disruption (more than 10 seconds)

4 Step Four: Design the Interface (Cont.)

Strategically think about each element.	• **Are the interface elements a reasonable size to interact with?** Elements, such as buttons, need to be big enough for a user to be able to select it • **Are edges and corners being used strategically to locate interactive elements like menus?** Since the edge provides a boundary that the mouse or finger cannot go beyond, it tends to be a good location for menus and buttons • **Are you following standards?** Users understand how interface elements are supposed to function
Simplify for learnability.	• **Is information chunked into seven (plus or minus two) items at a time?** People are only able to keep five to nine items in the short-term memory before they forget or make errors • **Is the user's end simplified as much as possible?** Remove complexity as much as possible from the user and instead build the system to take it into account while simplifying it up to a certain

Step Four: Design the Interface (Cont.)

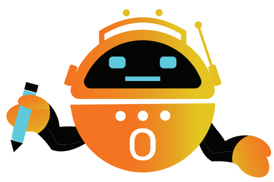
	point before it no longer functions • **Are familiar formats used?** Decision time is affected by how familiar a format is for a user to follow and how familiar they are with the choices

Specifically, for this step, you'll answer the following questions and use these answers in Step Five to design your interface.

Questions	Your Answers
What commands can a user give for interaction with the interface?	As it involves creation of very interactive interfaces, standard interface requirements to be satisifed, particularly on Audio & Touch Control.
What about the appearance (color, shape, size, etc.) gives the user a clue about how it may function?	As much as Vivid and Colourful with Animated pictures that enhances their imaginary skills. Customised as per Age and Gender if possible.
What information do you provide to let a user know what will happen before they perform an action?	Provide appropriate headings, descriptions with tiny images or thumbnails so kids can get preview of what they are going to do next.
Are there constraints put in place to help prevent errors?	Yes. This is quite crucial for the product success due to more frequent clicks and interactions. Focus on prevention than corrections.
Do error messages provide a way for the user to correct the problem or explain why the error occurred?	Expect machine intervene to correct or atleast highlight the errors as this interface involves kids. Ensure responses are more choice based than free text form.

4 Step Four: Design the Interface (Cont.)

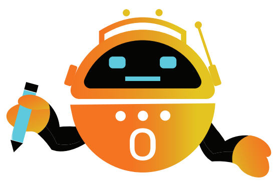
Questions	Your Answers
What feedback does a user get once an action is performed?	Simple, Easy and few elaborative feedbacks.
How long does it take between an action and a product's response time?	It has to be in Milliseconds and proper caching,paging are to be implemented for fast rendering. Able to handle more frequent pause, start or stop options and more keyboard interactions.
Are the interface elements a reasonable size for interaction?	Dedicated web screens will be designed for distinct use cases such as Novel to Video/Audio, VocabularyList etc.,
Are edges and corners strategically being used to locate interactive elements like menus?	Interface requirements for product's web version different from mobile, edges and corners are defined accordingly.
Is information chunked into a few items at a time?	chunking in terms of Audio recordings, paging/caching for faster upload or download, yet to explore for faster video streaming etc.,
Are familiar formats used?	It involves all formats of data from Structured Tables to Unstructured such as Video, Audio



5 Step Five: Create a Wireframe

Create a wireframe of the HCI interface. This should include the user application interface components and how this interface interacts with both the user and the application. You can sketch the image using pen and paper. You can also use word processing, presentation, or UX design software like Sketch, InVision, or Adobe XD.

Upload Your Image Here



6 Step Six: Evaluate HCI Usability Heuristics

Examine Jacob Neilson's ten principles for interaction design heuristics that can be used to evaluate an HCI interface.

Jacob's Ten Usability Heuristics are:

1. **Visibility of system status:** The design should always keep users informed about what is going on through appropriate feedback within a reasonable amount of time. When users know the current system status, they learn the outcome of their prior interactions and determine next steps.

   Predictable interactions create trust in the product as well as the brand. This can be achieved by communicating clearly to users what the system's state is and presenting feedback to the user as quickly as possible.

2. **Match between the system and the real world:** The design should speak the users' language. Use words, phrases, and concepts familiar to the user, rather than internal jargon. Follow real-world conventions, making information appear in a natural and logical order.

   The way you should design depends very much on your specific users. Terms, concepts, icons, and images that seem perfectly clear to you and your colleagues may be unfamiliar or confusing to your users.

   When a design's controls follow real-world conventions and correspond to the desired outcomes, it's easier for users to learn and remember how the interface works. This helps build an experience that feels intuitive.

3. **User control and freedom:** Users often perform actions by mistake. They need a clearly marked "emergency exit" to leave the unwanted action without having to go through an extended process. When it's easy for people to back out of a process or undo an action, it fosters a sense of freedom and confidence. Exits allow users to remain in

control of the system and avoid getting stuck and feeling frustrated. For example, support Undo and Redo and show a clear way to exit the current interaction, like a Cancel button.

4. **Consistency and standards:** Users should not have to wonder whether different words, situations, or actions mean the same thing. Follow platform and industry conventions.

   People spend most of their time using digital products other than yours. Users' experiences with those other products set their expectations. Failing to maintain consistency may increase the users' cognitive load by forcing them to learn something new. This can be done by improving learnability by maintaining consistency within a single product or a family of products.

5. **Error prevention:** Good error messages are important, but the best designs carefully prevent problems from occurring in the first place. Either eliminate error-prone conditions or check for them and present users with a confirmation option before they commit to the action.

   There are two types of errors: slips and mistakes. Slips are unconscious errors caused by inattention. Mistakes are conscious errors based on a mismatch between the user's mental model and the design.

6. **Recognition rather than recall:** Minimize the user's memory load by making elements, actions, and options visible. The user should not have to remember information from one part of the interface to another. Information required to use the design (e.g., field labels or menu items) should be visible or easily retrievable when needed.

   Humans have limited short-term memories. Interfaces that promote recognition reduce the amount of cognitive effort required from users.

Step Six: Evaluate HCI Usability Heuristics (Cont.)

7. **Flexibility and efficiency of use:** Shortcuts – hidden from novice users – may speed up the interaction for the expert user such that the design can cater to both inexperienced and experienced users. Allow users to tailor frequent actions.

   Flexible processes can be carried out in different ways so that people can pick whichever method works for them. For example, you can:

   - Provide accelerators like keyboard shortcuts and touch gestures.
   - Provide personalization by tailoring the content and functionality for individual users.
   - Allow for customization so that users can make selections about how they want the product to work.

8. **Aesthetic and minimalist design:** Interfaces should not contain information which is irrelevant or rarely needed. Every extra unit of information in an interface competes with the relevant units of information and diminishes their relative visibility.

   This heuristic doesn't mean you have to use a flat design. It's about making sure you're keeping the content and visual design focused on the essentials. Ensure that the visual elements of the interface support the user's primary goals. Keep the content and visual design of UI focused on the essentials, and don't let unnecessary elements distract users from the information they really need.

9. **Help users recognize, diagnose, and recover from errors:** Error messages should be expressed in plain language (no error codes). They should precisely indicate the problem and constructively suggest a solution.

   These error messages should also be presented with visual treatments that will help users notice and recognize them. Tell users what went wrong in a language they will understand, and this can be achieved by avoiding technical jargon.

6 Step Six: Evaluate HCI Usability Heuristics (Cont.)

10. **Help and documentation:** It’s best if the system doesn’t need any additional explanation. However, it may be necessary to provide documentation to help users understand how to complete their tasks. Help and documentation content should be easy to search and focused on the user’s task. Keep it concise and list the concrete steps that need to be carried out. Ensure that the help documentation is easy to search, and, whenever possible, present the documentation in context right when the user requires it.

Specifically, your task will be to select five of these principles and evaluate your final HCI design. For each heuristic chosen, write a one-to-two sentence response explaining how your final HCI design aligns with the select heuristic.

01 — Consistency and Standards

As intended audiences are kids under 9-11 age group, interface needs to be simple and familiar.

02 — User Control and Freedom

This is very important due to kids fast and frequent actions. Proper rules will be placed for every Icon interactions.

03 — Aesthetic and Minimalist design

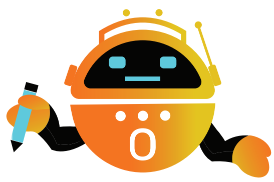
Information presented in interesting and fun way is pivotal for this product.

04 — Flexibility and efficiency of use

Navigation between pages, enabling easy writing, answers selections, play and record audio or video should be easy.

05 — Visibility and System Status

Progress track, Feedback Loop, Fun way to interact with chatbot and many other visibly appeal features are important



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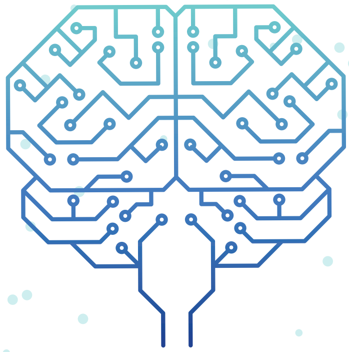

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