User interface design

Week4: Cognitive Aspects in User Interface Design: what is cognition, Cognitive frameworks

Nagulama Moses

Lecturer

Department Of Information Technology

Kumi University

Email: mnagulama@gmail.com

Outline

- Intended learning outcomes
- What is cognition
- Cognitive frameworks

Intended learning outcomes

- Understand the basic concepts of cognition and cognitive frameworks.
- Be able to apply cognitive aspects and cognitive frameworks to user interface design.
- Be able to evaluate user interfaces based on their cognitive aspects.

introduction

- Imagine a scenario where you are sitting Infront of your laptop yet its getting late in the evening and you have a presentation to make the following day but you are far to finish making the report.
- You realize you have so many notifications on your phone that need replies.
- Later, you realize its now midnight the presentation is not ready you start now closing all application.

- With the advent of smartphones and the Internet, it has become increasingly common for people to be switching their attention constantly among multiple tasks.
- The study of human cognition can help us understand the impact of multitasking on human behavior.

Cognition

- Mental process of acquiring, processing, and storing information.
- It includes a wide range of mental abilities, such as attention, perception, memory, learning, reasoning, and problem-solving.
- Cognition is essential for our ability to interact with the world around us and to make sense of our experiences.
- It allows us to learn new things, to solve problems, and to make decisions.

- They help designers to create interfaces that are easier to use and more efficient.
- Understanding how people think and learn, designers can create interfaces that minimize the amount of mental effort required to complete tasks and that are consistent with user expectations.

Examples of cognition in everyday life

- Paying attention to a conversation
- Reading a book
- Learning a new skill
- Solving a math problem
- Making a decision about what to eat for dinner
- Navigating your way around a new city

Different types of cognitive processes

- Cognitive processes are the mental processes that allow us to acquire, process, and store information.
- They include a wide range of abilities, such as attention, perception, memory, learning, reasoning, and problem-solving.
- Cognitive processes are essential for our ability to function in the world as they allow us to learn, grow, and interact with the world around us.

- **Attention**: The ability to focus on and process information from the environment. It is essential for learning, problem-solving, and making decisions.
- **Perception:** The process of interpreting sensory information to make sense of the world around us. It involves combining information from our different senses to create a complete picture.

- **Memory:** The ability to store and retrieve information.
- It is essential for learning, problem-solving, and making decisions.
- There are three main types of memory: sensory memory, short-term memory, and long-term memory.

- Sensory memory is the first stage of memory, and it is responsible for storing sensory information for a very brief period of time, typically less than a second.
- For example, when you look at a scene, sensory memory allows you to retain a brief image of the scene, even after you have turned away.
- Short-term memory is the second stage of memory, and it is responsible for storing information that you are currently paying attention to.

- Long-term memory is the third and final stage of memory, and it is responsible for storing information for a long period of time, or even permanently.
- Long-term memory has a vast capacity, and it can store an unlimited amount of information.

- **Learning:** The process of acquiring new knowledge and skills. It can be achieved through a variety of methods, such as formal instruction, observation, and experience.
- **Reasoning:** The ability to think logically and to draw conclusions from information. It is essential for problem-solving and making decisions.
- **Problem-solving:** The ability to identify and solve problems. It involves a variety of steps, such as identifying the problem, generating possible solutions, evaluating those solutions, and selecting the best solution.

- Cognitive processes are often interrelated. For example, attention is essential for learning and memory. Problem-solving requires attention, memory, and reasoning.
- Cognitive processes can also be influenced by a variety of factors, such as our emotions, our physical state, and our environment. For example, if we are stressed or anxious, it can be difficult to focus and to learn new information.

How people learn and remember information

- Attention: Paying attention to information is essential for learning and memory.
- Encoding: The process of converting information into a form that can be stored in memory.
- Storage: Information can be stored in memory for a short or long period.
- Retrieval: The process of accessing information from memory through a variety of methods, such as recall, recognition, and relearning.

Factors that influence learning and memory

- **Motivation**: People are more likely to learn and remember information if they are motivated to do so from a variety of sources, such as interest, curiosity, and the desire to succeed.
- **Prior knowledge**: People are more likely to learn and remember information if they have some prior knowledge about the topic.

- **Elaboration**: Connecting new information to existing knowledge through a variety of methods, such as providing examples, making analogies, and creating mental images.
- **Organization**: When information is organized in a meaningful way, it is easier to learn and remember.

- **Repetition:** Repetition is a key factor in learning and memory. The more times we are exposed to information, the more likely we are to remember it.
- **Emotion**: Emotion can also play a role in learning and memory. Information that is associated with strong emotions is more likely to be remembered.

How to improve learning and memory

- **Pay attention:** It is important to pay attention to the information that we are trying to learn.
- **Encode information effectively**: Using a variety of methods, such as visual imagery, verbal rehearsal, and organization.
- **Rehearse information regularly**: Helps to move it from short-term memory to long-term memory.

- **Elaborate on information:** Helps us to connect it to our existing knowledge, making it easier to learn and remember.
- **Organize information meaningfully**: Helps us to make sense of it and to remember it more easily.
- **Manage stress**: It is important to find healthy ways to manage stress, such as exercise, relaxation techniques, and getting enough sleep.

Cognitive frameworks

- Cognitive frameworks are models of how people think and learn.
- They can be used to understand how users interact with user interfaces and to design interfaces that are more efficient and effective.

Common cognitive frameworks

- Gestalt principles.
- Cognitive load theory.
- Mental models

Gestalt principles

- The Gestalt principles are a set of theories that describe how humans perceive visual information.
- They are based on the idea that the human brain is wired to group similar elements together and to see patterns in complex images to allow quickly and easily understand the world around us.

- The Gestalt principles can be used to create more effective and visually appealing designs i.e. if you want to emphasize a particular element in a design, you can place it in isolation or group it with similar elements.
- The following the gestalt principles:

- **Proximity:** Elements that are close together are perceived as being grouped together.
- **Similarity:** Elements that are similar in appearance are perceived as being grouped together.
- **Continuity:** Elements that are arranged in a continuous line are perceived as being grouped together.

- **Closure:** The human brain tends to fill in missing information to create a complete image.
- **Figure-ground:** We perceive images as being in the foreground and background of image.
- **Conciseness:** The human brain prefers simple, well-organized images.

Cognitive load theory

- Theory of learning that explains how the human brain processes information.
- Developed by John Sweller in the 1980s, and it has been used to improve learning in a variety of settings, including education, training.
- It is based on the idea that the human brain has a limited capacity for processing information and when too much information is presented at once, working memory can become overloaded, and learning will suffer.

Types of cognitive load

- **Intrinsic cognitive load**: The load that is inherent in the task itself i.e. learning a new language has a high intrinsic cognitive load because there is a lot of new information to learn and process.
- **Germane cognitive load**: The load that is involved in building new schemas, or mental frameworks, for understanding information.

- **Extraneous cognitive load**: The load that is caused by the way that the information is presented.
- For example, if a teacher is speaking too quickly or using too much jargon, this can increase the unnecessary learning on the students.

CLT recommends a variety of techniques to reduce the extraneous cognitive load:

- ❖Providing clear and concise instructions
- ❖Using diagrams and other visuals to support the text
- ❖Breaking down complex tasks into smaller steps
- ❖Providing opportunities for practice and feedback

Mental models

- Mental models are representations of the world in our minds. They are based on our experiences, knowledge, and beliefs.
- Mental models can be explicit, meaning that we are aware of them, or implicit, meaning that we are not aware of them.
- Learning new things, essentially update our mental model of the world and solving problems, we use mental models to generate and evaluate possible solutions.

- Mental models can also be harmful i.e. inaccurate model, they can lead us to make bad decisions.
- It is important to be aware of our mental models and to challenge them regularly.

Examples of mental models

- How a car works might include understanding the different parts of the car, interact with each other etc.
- How to cook a meal might include understanding the different ingredients, prepare them, combine them to create a dish.
- How to navigate a city might include understanding the different neighborhoods, streets, and how to get from one place to another.

How to use mental models in interface design

- Use visual cues to attract attention and guide users e.g. color, contrast, and proximity to group related elements.
- Minimize cognitive load i.e., break down complex tasks into smaller steps and provide users with feedback and guidance.
- Make interfaces consistent with user expectations i.e. use standard icons and controls and can place elements in familiar locations.

- Use clear and concise language. Avoid using jargon or technical terms that users may not understand.
- Provide clear and concise instructions. When asking users to complete a task, be sure to explain what they need to do in a clear and concise way.
- Use feedback to help users stay on track. Provide users with feedback on their actions so that they know if they are on the right track.

Designing for attention

- Designing for attention is the process of designing interfaces that are attention-grabbing and easy to focus on.
- This is important because users have a limited amount of attention, and they are constantly bombarded with stimuli from the world around them.

Common techniques for designing for attention

- **Using bright colors and bold fonts**. Used to catch users' eyes than more muted colors and smaller fonts.
- **Using visual contrast.** High-contrast/brightness elements are more likely to stand out to users.

- **Using motion**. Motion is a great way to grab users' attention.
- **Using white space**. Using white space can help to make elements more visually appealing and easier to focus on.

Designing for memory

- The process of designing interfaces that are easy for users to remember.
- This is important because users have a limited working memory, and they can easily forget information if it is not presented in a clear and concise way.

Common techniques for design for memory

- **Use chunking**. Chunking is the process of breaking down large tasks into smaller and more manageable chunks.
- **Use repetition.** By repeating important information multiple times, you can help users to encode it into their long-term memory.

- **Use visuals.** By using images, diagrams, and other visuals in your design, you can help users to learn and remember information.
- **Provide feedback**. Feedback helps users to know if they are on the right track and to identify any errors that they have made.

Designing for learning

- Designing for learning is the process of designing interfaces that are effective for teaching and learning.
- This is important because users can learn more effectively when the information is presented in a clear, concise, and engaging way.

Common techniques for design for learning

- **Using active learning**. This can be done by asking users questions, providing them with opportunities to practice what they have learned, and giving them feedback on their progress.
- **Using support**. This can be done by breaking down complex tasks into smaller steps, providing clear instructions, and offering hints and assistance when needed.

- **Using feedback**. This can help users to learn and remember information more effectively.
- **Using visuals**. By using images, diagrams, and other visuals in your design, you can help users to learn and remember information more effectively.
- **Using gamification**. Gamification is the use of game design elements in non-game contexts.

- **Use a consistent design language**. This will help users to learn how to use your design and to find the information that they need quickly and easily.
- **Organize your content logically**. This will help users to make sense of the information and to learn it more easily.
- **Test your designs with users**. This is the best way to ensure that your designs are actually effective for teaching and learning.

Designing for decision-making

- The process of designing interfaces that help users make informed decisions.
- This is important because users are constantly attacked with information and choices, and it can be difficult to make good decisions in a timely and efficient manner.

Common techniques for design for decision making

- **Providing clear and concise information**. It is important to provide this information in a clear and concise way, avoiding jargon and technical terms.
- **Organizing information logically**. Information should be organized in a logical way that makes it easy for users to find and understand using headings, subheadings etc.

- **Highlighting key information.** Some information is more important than other information when making a decision.
- **Using visuals**. Charts, graphs, and other visuals can help users to understand complex data and to compare different options.
- **Providing feedback**. Feedback helps users to know if they are on the right track and to identify any errors that they have made.

- Use a comparison table to help users compare different products or services. The table should include all of the key information that users need to make a decision, such as features, pricing, and customer reviews.
- Use a risk assessment tool to help users identify and evaluate the risks associated with different options.
- Use a feedback loop to help users learn from their decisions and make better decisions in the future.

References

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Thank you

Next Lecture We Shall Look At Social Interaction