Interaction design – follows the following phases; it is underpinned by the philosophy of user-centered design, that is, involving users throughout development.

DOUBLE DIAMOND DESIGN

- **Discover:** Designers try to gather insights about the problem.
- **Define:** Designers develop a clear brief that frames the design challenge.
- **Develop:** Solutions or concepts are created, prototyped, tested, and iterated.
- **Deliver:** The resulting project is finalized, produced, and launched.

➢ designs and potential solutions will need to be communicated to people other than the original designer.
➢ to be captured and expressed in a form that allows review, revision, and improvement.

What Is Involved in Interaction Design?

1. **Understanding the Problem Space** - Deciding what to design is key, and exploring the problem space is one way in which to decide.
   - the first phase in the double diamond
2. **The Importance of Involving Users -** it's the best way to ensure that the end product is usable and that it indeed will be used.
   - understand better how it will affect their jobs and lives and why the features are designed that way.
   - is ownership. Users who are involved and feel that they have contributed to a product's development are more likely to feel a sense of ownership toward it and support its use (Bano et al., 2017).
3. **Degrees of User Involvement -** fully engaged throughout all iterations of the development process to targeted participation in specific activities and from small groups of individual users in face-to-face contexts to hundreds of thousands of potential users and stakeholders Online.
   - Online feedback exchange (OFE) systems, which are increasingly used to test design concepts with millions of target users before going to market (Foong et al., 2017).
   - involve members of the public in helping them make a change in their lives where technology is often viewed as an integral part of the process.

What Is a User-Centered Approach?

- the real users and their goals, not just technology, are the driving force behind product development
- well-designed system will make the most of human skill and judgment, will be directly relevant to the activity in hand, and will support rather the constrain the user
- less of a technique and more of a philosophy

Three principles - useful and easy to use computer system *John Gould and Clayton Lewis (1985)*

1. **Early focus on users and tasks –** understanding who the users will be by directly studying their cognitive, behavioral, anthropomorphic, and attitudinal characteristics.
   - requires observing users doing their normal tasks, studying the nature of those tasks, and then involving users in the design process.
2. **Empirical measurement -** the reactions and performance of intended users to printed scenarios, manuals, and so forth, are observed and measured. Later, users interact with simulations and prototypes, and their performance and reactions are observed, recorded, and analyzed**.**
3. **Iterative design -** they are fixed, and then more tests and observations are carried out to see the effects of the fixes. This means that design and development are iterative, with cycles of design-test-measure-redesign being repeated as often as necessary.

Interaction Design Lifecycle Model

- Star and International standard Model ISO 9241 – 210 well known lifecycle model
- the final product will emerge
- in an evolutionary fashion from an initial idea through to the finished product or from limited functionality to sophisticated functionality

CONCEPTUALIZING HUMAN AND COMPUTER INTERACTION

- it is important to conceptualize them in terms of what the proposed product will do.
- referred to as creating a *proof of concept*
- viewed as an initial pass to help define the area and also when exploring solutions

- it can lead to better clarity, forcing designers to explain how users will understand, learn about, and interact with the product.

Conceptualizing Interaction

- Writing down your assumptions and claims and then trying to defend and support them can highlight those that are vague or wanting
- this process involves identifying human activities and interactivities that are problematic and working out how they might be improved through being supported with a different set of functions
- requiring thinking through how to design for an engaging user experience that does not exist.
- involves articulating the proposed solution as a conceptual model with respect to the user experience.

Benefits of conceptualizing the design space

- **Orientation.** Enabling the design team to ask specific kinds of questions about how the conceptual model will be understood by the targeted users.
- **Open-Mindedness.** Allowing the team to explore a range of different ideas to address the problems identified.
- **Common Ground**. Allowing the design team to establish a set of common terms that all can understand and agree upon, reducing the chance of misunderstandings and confusion arising later**.**

Conceptual model can then become a *shared blueprin*t leading to a testable proof of concept. It can be represented as a textual description and/ or in a diagrammatic form, depending on the preferred *lingua franca* used by the design team.

Conceptual Models - a high level description of how a system is organized and operates

- An abstraction outlining what people can do with a product and what concepts are needed to understand how to interact with it.
- key benefit, enables "designers to straighten out their thinking before they start laying out their widgets"
- provides a working strategy and a framework of general concepts and their interrelations

Core components:

1. *Metaphors and analogies* - convey to people how to understand what a product is used for and how to use it for an activity
2. The concepts to which people are exposed through the product, including the task-domain objects they create and manipulate, their attributes, and the operations that can be performed on them.
3. The relationships between those concepts.
4. The mappings between the concepts and the user experience the product is designed to support or invoke.

Interface Metaphors - central component of a conceptual model

- provide a structure that is similar in some way to aspects of a familiar entity (or entities)
- one that is instantiated in some way as part of the user interface, such as the desktop metaphor
- well-known one is the **search engine**
- provide familiar entities that enable people readily to understand the underlying conceptual model and know what to do at the interface.

Interaction Types - these are the ways a person interacts with a product or application.

1. *Instructing* - Where users issue instructions to a system. This can be done in a number of ways, including typing in commands, selecting options from menus in a windows environment or on a multi-touch screen, speaking aloud commands, gesturing, pressing buttons, or using a combination of function keys.
2. *Conversing* - Where users have a dialog with a system. Users can speak via an interface or type in questions to which the system replies via text or speech output.
3. *Manipulating* - Where users interact with objects in a virtual or physical space by manipulating them (for instance, opening, holding, closing, and placing). Users can hone their familiar knowledge of how to interact with objects.
4. *Exploring* - Where users move through a virtual environment or a physical space. Virtual environments include 3D worlds and augmented and virtual reality systems. They

enable users to hone their familiar knowledge by physically moving around. Physical spaces that use sensor-based technologies include smart rooms and ambient environments, also enabling people to capitalize on familiarity.

5. *Responding* - Where the system initiates the interaction and the user chooses whether to respond. For example, proactive mobile location-based technology can alert people to points of interest. They can choose to look at the information popping up on their phone or ignore it.

EVALUATION AND USER EXPERIENCE

- Experienced designers have attained the wisdom and humility to know that extensive testing and evaluation are necessities
- *Feedback* - breakfast of champions
- *testing and evaluation* - dinner of the gods

Factors that influence when, where, and how evaluation is performed within the development cycle:

• Stage of design (early, middle, late)
• Novelty of the project (well -defined versus exploratory)
• Number of expected users
• Criticality of the interface (for example, life-critical medical system versus
museum-exhibit system)
• Costs of the product and finances allocated for testing
• Time available
• Experience of the design and evaluation team
• Environment where interface is used

Rapid growth of interest in the user experience means that failing to test is now risky
indeed.

Failure to perform and document
testing as well as not heeding the changes
recommended from the evaluation
process could lead to failed contract proposals or malpractice lawsuits from users
where errors arise that may have been avoided if the problems had been detected
and changes made.

EXPERT REVIEWS AND HEURISTICS

A natural starting point for evaluating new or revised interfaces is to present them to colleagues or customers and ask for their opinions.

- *expert reviews* - more formal with test subjects can provide some useful feedback have proven to be far more effective
  - occur early or late in the design phase
  - the outcome may be a formal report with problems identified or recommendations for changes
  - should be sensitive to the design team ‘s ego, involvement, and professional skill; suggestions should be made cautiously in recognition of the fact that it is difficult for someone freshly inspecting an interface to fully understand the design rationale and development history.
- *Heuristic evaluation* - expert reviewers critique an interface to determine conformance with a short list of design heuristics, such as the Eight Golden Rules.
  - **Guidelines review** - The system is checked for conformance with the organizational or other guidelines document. Because guidelines documents may contain a thousand items or more, it may take the expert reviewers some time to absorb them and days or weeks to review a large project system
  - **Consistency inspection** - The experts verify consistency across a family of interfaces, checking the terminology, fonts, color schemes, layout, input and output formats, and so on, within the interfaces as well as any supporting materials.
  - **Cognitive walkthrough** - The experts simulate users walking through the system to carry out typical tasks. An expert might try the walkthrough privately and explore the system, but there also should be a group meeting with designers, users, or managers to conduct a walkthrough and provoke discussion.
  - **Formal usability inspection** - The experts hold a courtroom-style meeting, with a moderator or judge, to present the interface and to discuss its merits and weaknesses.

USABILITY TESTING AND LABORATORIES

- indicator of the profound shift in attention toward user experience and user needs since the early 1980’s.
- report provided supportive confirmation of progress and specific recommendations for changes
- produced dramatic cost savings

- **Usability labs** – The movement toward usability testing stimulated the construction of usability laboratories
    - makes an organization's commitment to usability clear to employees, customers, and users
    - Step -by-Step Usability Guide - shows all the steps from planning a usability test to performing the actual test and reporting the results.
    - Eye-tracking hardware and software – show where participants gazed at the display and for how long.
- **Ethics in research practices with human participants** - Participants should always be treated with respect and should be informed that it is not they who are being tested; rather, it is the software and user interface that are under study.
- **Think-aloud and related techniques** - invite users to think aloud about what they are doing as they are performing the task
    - prompting and listening for clues about how users dealing with the interface
    - Think-aloud protocols yield interesting clues for observant usability testers
    - informal atmosphere of a think-a loud session is pleasant and often leads to many spontaneous suggestions for improvements.
    - **The spectrum of usability testing -** designers are trying to conceive the correct design, or as a validation effort to ensure that certain requirements were met
        - *Paper mockups and prototyping* - Early usability studies can be conducted using paper mockups of pages to assess user reactions to wording, layout, and sequencing.
        - *Discount usability testing* - Quick approach to task analysis, prototype development, and testing. Advocates suggest 3-6 participants suffice to find major problems, enabling quick revisions.
        - *Competitive usability testing* - Compares new systems to previous versions or competitors' products. Similar to controlled experimental study, requires parallel task sets and counterbalanced system presentation.
        - *A/B testing* - Compares different system designs with two user groups. Randomly assigns control (no change) and treatment (change) groups, then measures differences. Commonly used in large-scale online experiments.
        - *Universal usability testing* - Evaluates systems across diverse users, hardware, software, and networks. Essential for products with international user bases, such as consumer electronics, web services, and e-government. Aimed at addressing issues to ensure success.
        - *Field tests and portable labs* - Deploy new interfaces in realistic or naturalistic field environments for fixed or longitudinal trials. Logging software captures error, command, and help frequencies, enhancing test effectiveness. Portable labs with recording capabilities support comprehensive field testing.
        - *Remote usability testing* - Conducted online, eliminating the need to bring participants to a lab. Enables larger, more diverse participant pools, enhances realism by testing in participants' own environments with their own equipment. Expands participant pool to include sophisticated users who may face physical challenges or remote locations.
        - *Can-you-break-this tests* - Game designers introduced this approach by challenging energetic teenagers to find flaws in new games. Users attempt to discover fatal flaws, promoting rigorous testing. Valuable for identifying weaknesses in any project. Users demand well-designed products and easily switch loyalties if alternatives are available.

SURVEY INSTRUMENTS

- User surveys, written or online, are cost-effective companions to usability tests and expert reviews. Clear goals and focused items are crucial for success. Survey design must ensure validity and reliability. Careful attention is needed during design, administration, and data analysis

Preparing and designing survey questions:

1. Prepare, review, and pilot-test survey forms before large-scale distribution.
2. Develop statistical analysis methods and presentation techniques in advance.
3. Directed activities yield better results than unplanned statistics gathering.
4. Verify respondent representativeness for accurate results.
5. Pre-test survey instruments to gather subjective impressions on interface aspects.
6. Online surveys reduce costs and effort, offering convenience for respondents.
7. Likert scale commonly used for rating statements on effectiveness and interface satisfaction.
8. Use bipolar semantically anchored items to gauge reactions and preferences.
9. Evaluate various aspects of interface design for user feedback.
10. Precise survey questions yield actionable insights.

Evaluation during Active Use and Beyond

- A well-designed and tested interface is valuable, but ongoing attention from managers, user-service personnel, and maintenance staff is crucial for successful active use. Continuous refinement based on user feedback leads to improved service levels. While perfection may be unattainable, incremental improvements are achievable and worthwhile.
    - *Interviews and focus-group discussions*: Productive for understanding specific user perspectives. Costly and time-consuming, involving only a small fraction of the user community. Direct contact yields constructive suggestions.
    - *Continuous user-performance data logging:* Essential for collecting interface usage patterns, user performance speed, error rates, and assistance requests. Guides hardware acquisition, operational changes, training improvements, and system expansion. Allows for simplifying access to frequently used features and understanding why certain features are underutilized. Optimizes performance and reduces costs for all participants.
    - *Online or chat consultants, e-mail, and Online suggestion boxes*: Offer personalized assistance and reassurance to users facing difficulties. Provide valuable insights and suggestions for improvements. Some systems allow consultants to monitor and guide users through tasks. Software agents with recommender systems enhance real-time chat facilities, integrating human support with automation.
    - *Discussion groups, wikis, and newsgroups:* Provide platforms for users to seek advice, share experiences, and ask questions about software packages and interface features. Moderators ensure quality by removing irrelevant or offensive content. Powerful search engines facilitate finding relevant discussions. Geographically dispersed users may require extra effort from moderators to foster community.
    - *Tools for automated evaluation*: Effective for assessing user interfaces in various applications. Simple tools like spell checkers benefit interaction designers. Metrics track project size, while sophisticated evaluation procedures identify issues like menu depth or label consistency. Recommendations include keeping link text concise and using sans serif fonts. In some cases, attractiveness may outweigh rapid task execution in user preference. Further analysis can inform design goals for high user preference.