User-Centered Design Principles in Practice: Building a Simple AI Recommendation System

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# Abstract

This paper documents the design and development of a simple content‑based recommendation system delivered through a Streamlit graphical user interface (GUI). Grounded in user‑centered design (UCD) and Nielsen’s usability heuristics, the project adapts well‑known examples of TF‑IDF and cosine similarity recommenders and extends them with lightweight personalization and explanations. I review UCD principles, summarize evaluation methods, and discuss how AI is changing traditional design approaches. I then connect these ideas to everyday products that exemplify (and violate) user‑centric design.

# Introduction

User‑centered design (UCD) is an approach that places people’s needs, abilities, and contexts at the center of the development process. In software projects, UCD emphasizes iterative discovery, testing, and refinement to deliver solutions that fit real user problems. To make these concepts concrete, I built a small AI‑based recommendation system and deliberately applied UCD principles and usability heuristics in its interface and logic.

# Defining User‑Centered Design and Associated Principles

UCD is characterized by continuous focus on users and tasks, empirical measurement, and iterative design. In practice this means discovering user goals, prototyping, observing behavior, and refining the product. When combined with modern delivery approaches like Agile and Lean Startup, UCD helps teams explore user needs and pivot based on evidence (Signoretti et al., 2020).

# Usability Heuristics and How They Are Evaluated

Nielsen’s ten heuristics remain a practical, low‑cost way to spot usability issues: visibility of system status; match between system and the real world; user control and freedom; consistency and standards; error prevention; recognition rather than recall; flexibility and efficiency of use; aesthetic and minimalist design; help users recognize, diagnose, and recover from errors; and help and documentation (Nielsen, 1994/2024). Heuristic evaluation can be performed quickly by experts or trained reviewers and continues to be widely used alongside methods like cognitive walkthroughs and pluralistic walkthroughs (Samrgandi, 2021).

In this project I used heuristic evaluation as a checklist to shape the GUI: a loading spinner and success notifications provide visibility of status; plain language labels match real‑world phrasing; a Reset button supports user control; standard Streamlit widgets maintain consistency; multiselect lists reduce error; and a minimalist layout lowers cognitive load.

# Project: A Simple AI‑Based Recommendation System

I adapted ideas from two foundational examples of content‑based recommenders using TF‑IDF and cosine similarity on movie metadata (Ibtesam, n.d.; Banik, n.d.). My implementation extends these with a hybrid query‑plus‑profile approach (averaging a text query vector with an on‑the‑fly user profile derived from liked items) and an explainability panel that surfaces the top contributing terms for each recommendation. The interface is a Streamlit app designed with the heuristics above.

Key design decisions were driven by UCD: (1) transparency—users can see \*why\* an item matches; (2) control—users can add/remove likes and change the query without penalties; and (3) efficiency—defaults and constrained controls help novices while sliders and free‑text search support experts.

# Evaluation Methods

For a classroom‑scale project, quick heuristic evaluation is feasible and informative. Literature highlights heuristic evaluation as an industry‑standard, efficient method often paired with walkthroughs (Samrgandi, 2021). Future extensions could incorporate lightweight A/B preference tests and satisfaction surveys aligned with AI‑specific UX scales (e.g., transparency, control, trust).

# How AI Is Changing Traditional Design Approaches

AI introduces probabilistic behavior, personalization, and opaque models, which raise new UX demands: communicating uncertainty, providing meaningful control, and explaining outputs. Research on combining UCD with Lean Startup and Agile shows how discovery and iterative validation can be integrated into delivery cycles (Signoretti et al., 2020). Emerging work on evaluating AI experiences emphasizes criteria like explainability and user trust, suggesting additions to classic heuristics.

# Everyday Examples of User‑Centric and Non‑User‑Centric Design

Good examples include: a transit app that surfaces real‑time delays (visibility of status) and natural‑language search for destinations (match to the real world). Poor examples include: kiosks that hide critical options behind ambiguous icons (violating consistency and recognition) or apps that reset forms on minor errors (poor error prevention and lack of user control).

# Conclusion

By grounding a small AI recommender in UCD and heuristic evaluation, we can deliver a transparent, controllable, and efficient experience even with simple models. As AI systems diffuse into everyday products, extending classic heuristics with concepts like transparency and uncertainty communication becomes essential.

# References

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