RE-EXAMINING WHETHER, WHY, AND HOW HUMAN-AI INTERACTION IS UNIQUELY DIFFICULT TO DESIGN

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Premise:

- AI is becoming more and more relevant to HCI and UX designers
- Research shows that HCI designers are facing issues when dealing with *AI as a design material*
  - Common methods of sketching and prototyping are difficult to adapt to the design of AI systems

Goal:

- Map out the types of challenges designers have with AI
- Try to rethink why human-AI interaction is difficult to design
- Introduce a framework showing the effects of the complexities of designing human-AI interaction
- Demonstrate the usefulness of the framework

Lit review: the challenges

- Understanding what AI can and cannot do
- Envisioning new use cases for AI in UX
- Iterative prototyping and testing may require actually deploying the AI system
- Crafting appropriate interactions for UX and worries about ethical issues
- Collaborating with AI engineers: finding them, finding a shared workflow, and finding a common language

Lit review: improvement suggestions

- Improving designers' technical literacy
- Facilitating design-oriented data exploration
- Creating tools that enable designers to play with AI for ideation
- Aiding designers to evaluate AI outputs
- Creating AI-specific design processes

Three questions for provocation: *whether*, *why*, *and how is AI difficult to design*

- What is AI?
  - *"The technical boundary of AI, even in AI research communities, is disputed and continuously evolving"*
  - *"What makes a challenge distinctly AI and not a part of the many challenges designers regularly face in HCI and UX work?"*
- What are AI's capabilities and limits?
  - *Most work has focused on how AI functions, but not on what it can and can't do*
  - *"Can an articulation of AI's capabilities foster a more incisive examination of its design challenge?"*
- Why is prototyping AI difficult?
  - *"Interrogating why is it difficult to abstract AI-powered interactions into sketches and prototypes" may help to understand the other design challenges*

Method

- 1. Identified an operational bounding of AI
  - *“computational systems that interpret external data, learn from such data, and use those learnings to achieve specific goals and tasks through flexible adaptation”*
- 2. Within this bounding, curated a set of human-AI interaction sketching and prototyping processes as case studies
  - *Several studies on a) designing UX for AI applications, b) the work of UX practitioners, c) teaching a workshop and a course on UX design*
- 3. Synthesized the case studies to find a useful framework

The framework

Two main attributes of AI “central to the struggles of human-AI interaction design”:

- capability uncertainty (uncertainties surrounding what the system can do and how well it performs)
  - *“AI’s capability uncertainty is at its peak in the early design ideation stage, when designers work to understand what design possibilities AI can offer generally”*
  - *“The range of AI’s available capabilities includes more than the capabilities of existing AI systems”*
  - *“What AI can do for a UX problem at hand becomes clearer once a functioning AI system is built”*
  - *“Anticipating the situated, user-encountered capability of AI is difficult, yet it is fundamental to user experience design”*
- output complexity (complexity of the outputs that the system might generate)
  - *“When designing systems that produce many possible outputs, sketching and prototyping become more complex and cognitively demanding” (drive route recommendation, Siri)*

Using the framework

- summarized four levels of AI systems according to their design complexity
- used Level 1 and 4 systems as examples since they represent the two extremes of complexity

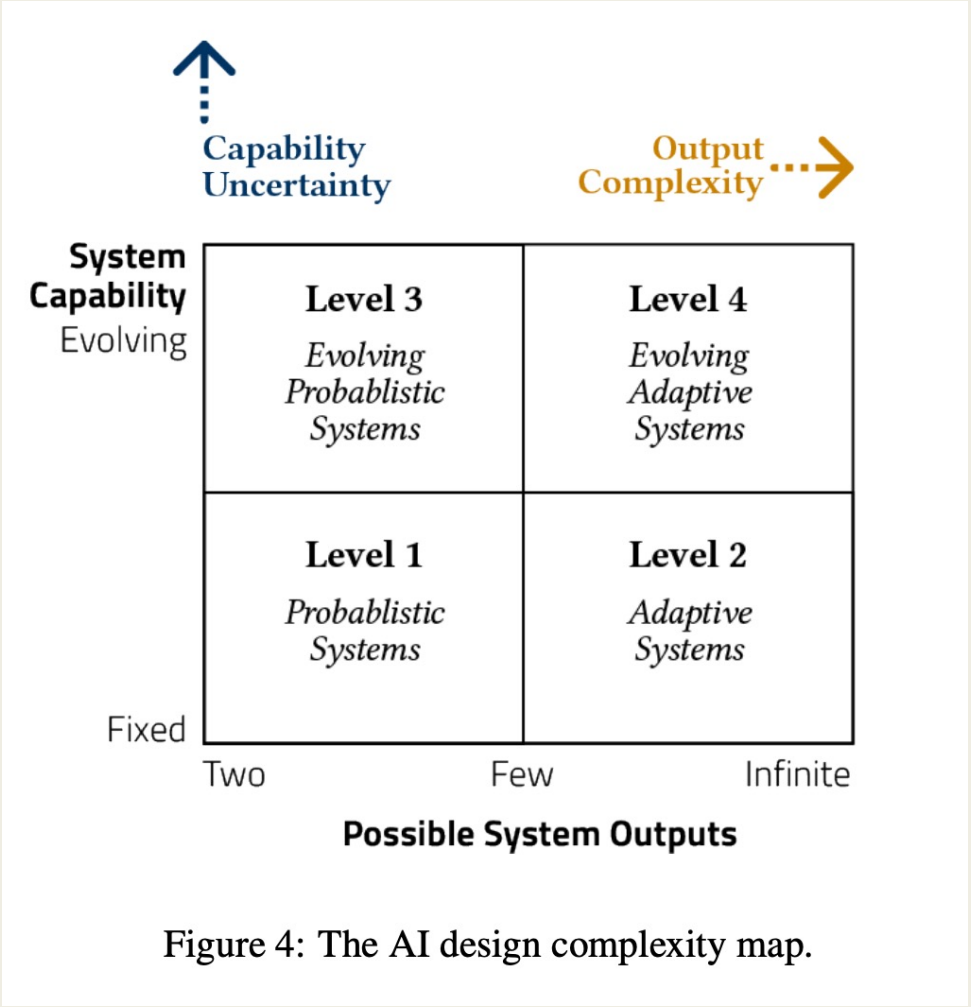

Figure 4: The AI design complexity map.

Using the framework

- Level 1: probabilistic systems
  - *learn from a self-contained dataset*
  - *produce a small, fixed set of outputs (e.g. face detection, hate speech detection)*

  Challenges:
  - *No particular challenges in understanding AI capabilities*
  - *No particular challenges in envisioning novel and feasible designs of the technology*
  - *No particular challenges in iterative prototyping and testing*
  - *No particular challenges in collaborating with engineers*

Using the framework

- Level 4: evolving, adaptive systems
  - *learn from new data even after deployment*
  - *produce adaptive, open-ended outputs that resist abstraction*
  - *e.g. search engines, newsfeed rankers, automated email replies, recommender systems*

  Challenges:
  - *Challenges in understanding AI capabilities: it is difficult to anticipate what the system can reliably do, when and how it is likely to fail*
  - *Challenges in envisioning novel and feasible designs of the technology: re-imagining new uses of a complex tool can be difficult*
  - *Challenges in iterative prototyping and testing: the system's performance evolves over time through user engagement*
  - *Challenges in collaborating with engineers: understanding how the performance will evolve with user engagement, how to mitigate biases and errors, and how to detect AI errors from user interactions*

How the framework helps

- Identifying root challenges
  - *AI "capabilities are adaptive"*
  - *AI "outputs can autonomously diverge at a massive scale"*
- Articulating the contributions and limits of emergent design methods/tools/processes
  - *rule-based simulators are effective in prototyping level 1-2 systems, but not level 3-4 systems*
- Providing new insights for future research
  - *framing level 3 and 4 systems as living, sociotechnical systems reveals insights into more effective interaction prototyping*
  - *research has investigated how to prototype workplace knowledge sharing systems whose use co-evolves with user behavior, interaction among users, and the organizational context*