Emergent HCI Approaches to Envisioning with Generative AI Capabilities

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ABSTRACT

In this position paper, I reflect on how designers might effectively engage generative artificial intelligence as a design material. I argue that the majority of HCI and design research focuses on *prototyping* AI systems, and I make the case for *envisioning* many AI systems before committing to building one. First, I highlight three emergent HCI approaches to envisioning novel forms and functions of generative AI. Next, I outline research implications of these emergent approaches. By sharing these insights, I hope to deepen the discussion around developing tools, methods, and boundary objects for effectively envisioning human-AI interactions that leverage generative AI capabilities.

KEYWORDS

user experience, artificial intelligence, generative AI, design

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1 INTRODUCTION

Artificial intelligence (AI) plays an increasingly important role in the user experience (UX) of products and services. Generative AI systems enable machines to communicate with users in natural language, help people write emails faster, and recreate digitized media in higher quality. Leveraging AI capabilities to envision novel interactions and experiences has led to the idea of AI as a design material in HCI [3]. While generative AI capabilities are increasingly maturing (e.g. image synthesis, speech synthesis), there is little HCI and design research to situate these capabilities valuably in people's lives [12].

Design innovation typically follows technical advances. Interaction designers create novel, valuable products and services by "playing with" existing technologies in unexpected ways. This idea of playing with technology materials is about *envisioning*: what is the right thing to design? Philips' invention of the cassette recorder provides a great example of how design innovation follows a technical advance. Product design teams built on the advance of cassette recorder to place the capabilities (playback and recording of audio from a cassette) into many new forms that created value in people's lives: boomboxes for bedrooms, playgrounds, and workplaces; car stereos that offer more musical control than a radio; home-phone answering machines for people to receive messages without being present to take the call; and the Sony Walkman, which offered a personal music experience on the go.

Once product teams envision many novel forms of technology advances, they move onto *prototyping*: how to build this thing right? Continuing with the cassette recorder example, this would involve the design of the specific interactions in a way that fits users' mental models, such as the conceptual design of "playback" and "record" functions. Envisioning allows creating technology products that people will want to use, while prototyping helps to ensure that the technology is usable.

I argue that current interaction design approaches to AI often focus on prototyping: designers work to mitigate issues around usability, user acceptance, trust, privacy, ethics, and explainability. For example, there is a considerable amount of work that investigates how people use generative AI systems in certain contexts, such as typing emails with phrase suggestions [2] or in creative tasks such drawing [8]. Envisioning with AI capabilities is relatively under investigated, especially with generative AI [13].

My research investigates empowering interaction designers in envisioning with AI capabilities. To illustrate what I mean by envisioning with AI, I describe a set of projects from the HCI literature that set out to explore *what is the right thing to build with generative AI capabilities*. Building on this synthesis, I outline key research directions to empower practitioners in envisioning with AI: (1) developing tools and methods to sensitize practitioners to AI capabilities, (2) collecting and curating datasets to explore the boundaries of AI capabilities, and (3) developing tools and methods for cross-disciplinary teams to collectively envision AI systems.

2 ENVISIONING WITH GENERATIVE AI

Here I curate three projects that highlight emergent approaches to envisioning with generative AI capabilities. These are Research through Design (RtD), matchmaking, and generative AI for HCI.

2.1 Research through Design

As I have noted earlier, AI capabilities are typically built through a technology-driven approach. Once the capabilities are there, use cases and applications follow. As a result, there can be a mismatch between the AI system's objectives and the users' needs. Following

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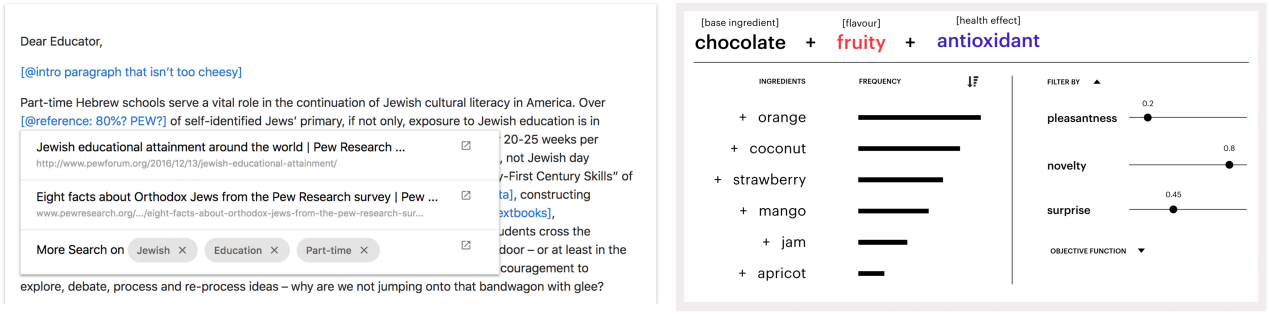

Figure 1: Emergent approaches include (left) Research through Design to envision intelligent writing assistance [11], and (right) matchmaking to explore the intersection of AI capabilities and user needs [9].

a user-centered approach earlier in the AI development process helps to mitigate this mismatch by exploring user current needs and future desires. Yang et al.'s work on envisioning intelligent writing assistance is a great example of the RtD approach to generative AI [11]. In this work, HCI and NLP practitioners collaborated to explore how they might be able to improve the authoring experience in a Word document editor (Figure 1). Instead of pre-identifying author needs, they conducted fieldwork with authors (e.g. observations, interviews) to uncover their unmet needs.

Their design process and ideation resulted in various NLP-powered user experiences that are both feasible and valuable. For example, their fieldwork revealed that authors need help in translating their bullet list thoughts into a natural flow. To structure these, they searched for rhetorical structure examples on Google, such as a phrase that connects two contrasting ideas. By reframing writing assistance as search, researchers were able to move between NLP problem spaces (e.g. search, question answering, text summarization) before building a certain type of text generation model.

This type of envisioning is suitable for envisioning new AI systems, as well as envisioning new features for an existing AI system. However, there are several challenges to this approach. First, interaction designers struggle with gaining an understanding of AI capabilities, often envisioning ideas that cannot be built [11]. Second, problems uncovered by user research might not require an AI system to solve, or they might be beyond current AI capabilities. For example, one of my ongoing projects explores NLP opportunities in the context of healthcare. Our early fieldwork revealed that clinicians desire text completion features, such as Gmail's Smart Compose, to accelerate their documentation process. However, how clinicians write medical notes are quite different from how people write emails. Our dataset was not consistent enough to train a new model as clinicians tend to write in unique, unstructured, and abbreviated ways.

2.2 Matchmaking

Another, complementary approach to envisioning with AI is matchmaking [1]. Matchmaking takes the technical capabilities as a starting point, and works backwards to systematically discover activities, domains, and target users connected to these capabilities. This type of targeted ideation requires a good enough understanding of both AI capabilities *(the types of problems generative AI can solve)* and human needs *(there is a need for this solution)*.

This approach is rather under investigated and under utilized. One example is an experimental project by Accenture researchers investigating generative AI in the context of culinary recipes [9]. Building on their expertise on computational creativity and knowledge graphs, the AI innovation team recognized an opportunity for developing an AI-based recipe inspiration tool for chefs. They developed a knowledge graph trained on a large database of flavor combinations and recipes. They created an interface for chefs to explore unusual but pleasant combinations to then create new recipes. While there have been various GPT-3 applications for recipe generation, their implementation privileges discovery and surprise by incorporating user controls, such as novelty, surprise, and pleasantness (Figure 1).

Building on the matchmaking approach, interaction designers can explore the capabilities of existing AI models. Recent discussions highlight how prompt design and tuning may reveal new capabilities of large language models [5]. However, similar to the RtD approach, there are challenges around envisioning new use cases for existing AI capabilities. One challenge is finding training data for the envisioned input/output pairs, as a model that was trained on a benchmark research corpus might not perform well in another corpus [11]. Additionally, envisioning with AI capabilities requires HCI, AI, and domain experts to work together to find the intersection between what is feasible and what is valuable [13]. There are open challenges around cross-disciplinary collaboration, such as building a shared language or a shared development process.

2.3 Generative AI for HCI

The third emergent approach is a meta-approach that explores how AI capabilities might support HCI and interaction design processes. This conceptualization is similar to AI as an agent rather than an intelligent tool, yet the intended end users are interaction designers. Martelaro et al.'s work on remote contextual inquiry through speech synthesis provides an excellent example [6]. Using AI capabilities, authors instrumented a self-driving car with a remote Wizard-of-Oz system, where the researchers could conduct remote user studies through the vehicle's intelligent assistant. While this

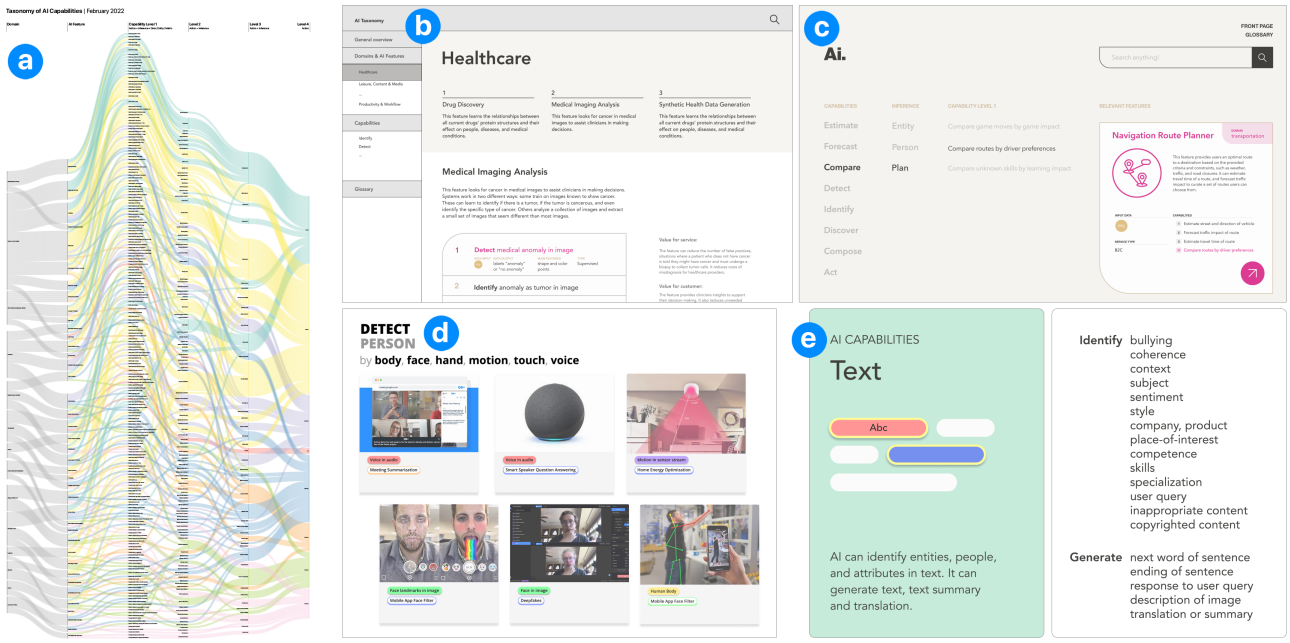

Figure 2: I developed a taxonomy of AI capabilities across domains and applications (left) which can be presented in various forms to sensitize practitioners to envision with AI (right).

type of applications might not seem novel from an implementation perspective, the way AI is utilized may reveal many novel opportunities from a design methods perspective.

Recently, similar experiments are being shared by industry practitioners, such as IDEO's exploration of GPT-3 as a creative agent for brainstorming [10], or using GPT-3 to generate personas [4]. The barrier to experimenting with generative AI tools and libraries are low, however, the envisioned tools and processes are likely to inform research instead of becoming immediately realized product and service innovations.

3 PROMPTS FOR WORKSHOP DISCUSSION

The above synthesis of emergent approaches reveals several challenges in envisioning with AI capabilities. Here, I outline three research directions that can support interaction designers in envisioning as starting points for workshop discussion.

- *Developing tools and methods to sensitize practitioners to AI capabilities:* Unlike other technology materials, such as traditional software or sensors, AI capabilities are not immediately understood. There is a great need for design tools and methods to sensitize interaction designers to AI's capabilities and its dependency on data. To address this problem, I created a taxonomy of AI capabilities that explicitly lists what AI can do along with exemplars across domains. Figure 2 shows this taxonomy and how it can be presented as a card deck to support the process of envisioning (Figure 2e).
- *Collecting and curating datasets to explore the boundaries of AI capabilities:* Both RtD and matchmaking approaches focus on exploring existing AI capabilities. However, capabilities are often dependent on training corpuses. Recently, some researchers speculated that collecting and curating datasets allows designers to envision and extend AI capabilities. For example, Lee et al. collected GPT-3 assisted writing interaction dataset from 63 writers to reveal generative capabilities of large language models [5]. Similarly, human-AI interaction researchers created a web-based tool to explore GPT-3 interactions [7]. More research is needed to understand what type of data is important to collect to inform the design of future AI systems.
- *Developing tools and methods for cross-disciplinary teams to collectively envision AI systems:* Prior work shows that interaction designers benefit from boundary objects that can scaffold their conversations with AI experts [11, 13]. To collectively envision AI innovations, practitioners need to be able to discuss the AI capability and the availability of data, as well as the user value created by the AI system. How can we generate tools and boundary objects to effectively span the gap across multiple roles and stakeholders in AI development processes?

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