

Title: How do multiple LLM-powered conversational agents assist sensemaking and decision-making in an unfamiliar domain?

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Abstract:

Unfamiliar decisions — decisions where people lack adequate domain knowledge or expertise — require individuals to first explore and understand the domain before engaging in the decision-making process. While large-language models (LLMs) show potential in aiding this process through their capacity for easy retrieval and flexible generation of information, the linear structure of many LLM interfaces poses limitations for iterative and flexible exploration and comprehension of information. In this work, we present ChoiceMates, a multi-agent conversational system designed to support the unfamiliar decision-making process. In ChoiceMates, the user can converse with a dynamic set of LLM-powered agents for holistic domain understanding and efficient discovery and management of information. We report on our exploratory observation involving 12 users and highlight major interaction patterns with multi-agents, and discuss the implications of a multi-agent system for sensemaking with LLM.

Introduction

Among numerous decisions people make every day, many can be classified as **unfamiliar decisions** — decision situations where the user does not have sufficient domain knowledge or expertise. In unfamiliar decisions, individuals need to first grasp the fundamental knowledge of the domain before delving into the decision-making process [1, 2]. As such decisions require quick sensemaking of the domain to make an informed decision [3], a promising approach to assist this process is through large-language models (LLMs), through its capacity of easily retrieving and generating comprehensible information [4]. However, popular LLM interfaces such as ChatGPT or Bard lack functional support due to its linear structure, making it difficult to assist sensemaking which is iterative in nature [5].

In this work, we propose a multi-agent representation to assist unfamiliar decision-making, where multiple agents could collectively assist the user’s exploration and understanding of diverse viewpoints and personalized information [6]. We designed and developed ChoiceMates, a multi-agent conversational system where the user can converse with a dynamic set of agents. We ran an explorative study with 12 participants to understand different user interaction patterns with multi-agents and discuss the implication of a multi-agent system with existing sensemaking support with LLM.

ChoiceMates: A Multi-agent Conversational System

ChoiceMates is a system that supports unfamiliar decision-making with multi-agent, conversational interactions powered by LLMs. The system consists of two parts, including a *conversation space* (Fig. 1-2) where the user can converse with selected agents and a *summary bar* (Fig. 1-1) to keep track of the conversation and the user’s preferences and options.

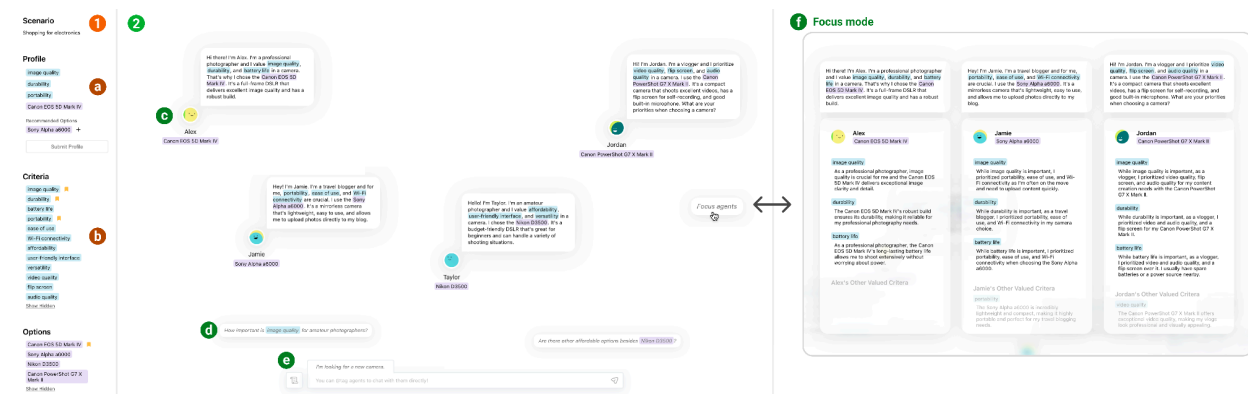


Figure 1: The ChoiceMates interface. On the left is the (1) summary bar consisting of (a) user profile where the user can pin important criteria and options and (b) a pile of discovered criteria and options through the conversation. On the right there is the (2) conversation space, consisting of (c) agents and their messages, (d) thought bubbles to suggest messages, (e) an input box, and (f) focus mode for comparison view of agent information.

Agents

Agents (Fig. 1-c) are the basic unit of interaction in ChoiceMates. Each agent is characterized by its persona (i.e., a single-line description of the agent), a set of criteria (i.e., factors to consider in the domain) they value, and a single option (i.e., an available choice in the domain) they chose with the criteria.

The agents are designed to reflect an individual's choice and their underlying values and experience in real life. They work as an externalization of the link between an option and criteria, to support gaining an easy understanding of the domain and elicitation of user's preferences. The constraint of one agent favoring one option was inspired from Yasuhiko et al's work [7] showing that novices preferred case-based preference elicitation.

Throughout the conversation, the user can choose any set of agents or tag them in the input box to ask for information or opinions. New agents could join in if necessary or requested, and agent-agent conversations can occasionally take place.

Conversation management and guidance

On top of the agents and their messages, ChoiceMates has additional features to guide the users through the decision-making process.

When the user needs support in looking for more information in the domain, they can use the Thought Bubbles (Fig. 1-d) to get new ideas for messages to ask. Thought Bubbles are updated each turn, reflecting the conversation history.

All discovered keywords (criteria and options) are automatically piled to the Summary Bar (Fig. 1-1). The user can click on keywords to move up the relevant agents in the conversation space. They can also select a set of agents and enter the Focus Mode (Fig. 1-f) to check each agent's opinion on criteria as table-like views.

To link the discovered and managed information to the user's context, there is a user profile (Fig. 1-a) where bookmarked criteria and options from Summary Bar are stored. The user can update their profile anytime, which is made aware to the agents in providing their responses.

Exploratory User Study

Setup

We selected three decision domains: buying a camera, choosing a plant to grow, and deciding on an instrument to learn. We recruited a total of 12 participants (4 per domain) via a

screening survey to check their domain knowledge on selected domains. The study lasted for one hour, consisting of introduction (10 mins), decision-making task (30 mins), and post-interview (20 mins) on the interface features and the overall unfamiliar decision-making process. The participants were compensated 20,000 KRW (approximately 15 USD) for their participation.

Interaction patterns exhibited with ChoiceMates

Talking to all agents to elicit diverse information in the domain: When participants did not have any clue about the domain or have yet established any preferences in the domain, they chose to talk to all agents, so that they could gather diverse and occasionally serendipitous perspectives in the domain through agent-agent conversations. For example, when P1 (*instrument*) asked "I see myself having jamming sessions with my friends. Which instrument works better?", P1 saw Taylor and Casey agreeing with each other on cajon, which led them to explore more into cajon in their next conversations.

Tagging multiple agents to effectively comprehend the domain: After participants had a decent understanding of the domain, they tagged multiple agents at once to quickly retrieve information and compare them. This also reflected the mental space of the participants, where P3 (*plant*) entered the focus mode four times with 4, 3, 6, and 4 agents respectively.

Conversing with one highly relevant agent for deeper understanding: When participants related themselves to a certain agent, they chose to converse further to retrieve specific information and opinions the agent can provide. For example, P11 (*instrument*) conversed with Pat (electric guitar) 11 times throughout the conversation, where the conversation not only contained specific questions ("What's the role of an amplifier? Is it necessary to have?"), elicitation of preferences ("I guess pop and rock."), but also asked for advice ("I'm a beginner and the \$100 guitar sounds attractive. Is it a good enough quality guitar, in your opinion?") expecting the answer from Pat's perspective.

Multi-agent representation for sensemaking with LLM

A recent work by Suh et al. [8] demonstrated support for nonlinear, multi-level exploration and sensemaking of LLM-generated text. Both Sensecape and ChoiceMates support seamless switching between foraging and sensemaking. However, they use different representations in aiding the process. In Sensecape, *canvases* function as basic units, so that the user can broaden their information search within the canvas or expand them to visually structure the information found. On the other hand, ChoiceMates uses agent as the basic unit of information, where criteria, options, and information in connection to such values are all stored inside the conversation with each agent. Because of the difference, Sensecape shows a stronger support for establishing hierarchical relationships between information, whereas ChoiceMates shows potential for exploring diverse viewpoints around an information and

connecting that to the user's context but less in supporting external structuring of information. We envision two representations to be combined, where the multi-agent representation could be added to each of the canvas for the user to explore diverse interpretations within a concept, while keeping a structured understanding established and externalized through the hierarchy view.

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