A Preliminary Expansion of the Natural Conversation Framework to Model Patterns of Human-AI Engagements That Facilitate Co-learning

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Challenge and Research Question

Conversational chatbots are increasingly available or considered for military training (Schimer & Léveillé, 2010; Yuan, Ki, & Peng, 2023). While performance improvements have been demonstrated (Ganguly & Mondal, 2024), many challenges critical to defense use cases remain, including the incompleteness of goal-driven systems, patterns embedded in AI or language and cultural gaps (Chmyr & Bhinder, 2023; Rashid et al., 2023).

To realize the potential of human-AI teaming (HAT) as observed in healthcare (Bienefeld et al., 2023), we seek to overcome these barriers by providing conversational AI with a robust library of interaction patterns that facilitate bidirectional or co-learning as is the case for issue resolution in customer service (Moore & Arar, 2019; Kahn et al., 2020).

Background

- The Natural Conversational Framework (NCF; Moore, 2018; Moore et al., 2023) is a conceptual method designed to structure conversational user experience in the context of chatbots and HAT systems.
- It helps create intuitive and user-friendly engagements by emulating natural human conversations that feel seamless and authentic. Practical guidelines to implement NCF (Moore & Arar, 2019) identify conversational categories, patterns, and units.
- An example of conversational category is “Conversational Activities (A)” which consists of five high-level patterns (A1 through A5), as well as combinations of these patterns. An example high level pattern is “Open Request (A2)” whereby a human asks an open-ended question to an agent.

Approach

- Our initial inquiry into NCF for bidirectional learning focused on the first category of patterns, Conversational Activities (A). We reviewed the five A patterns (A1 through A5), the two combined patterns (A2+A3 and A3+A4), and the 24 sub-patterns (A1.1 through A1.5). Human factors and AI engineers appraised the utility, usefulness, and understandability of NCF patterns to a co-learning HAT in the context of a military use case.
- Our preliminary use case consisted in an intel analyst reviewing imagery to assess the status and intent of adversarial forces or the environment to estimate blue capabilities. Two scenarios were developed, one with equipment and overhead imagery in a local theater of operations with ground forces, the other with ground-based photography of various rescue mission situations. Typical co-learning questions would include “Is this a tank of type A or B?” or “How many vehicles are visible?” for the former scenario, and “Why is this a helicopter of type C?” or “Can a helicopter fly through this area?” for the latter.

Findings, Analysis, and Recommendations

We assessed that four A patterns (A1 Inquiry [user], A2 Open Request, A3 Extended Telling with Repair, and A5 Inquiry [agent]) reasonably apply to our use case: These patterns can be employed as part of conversational sequences driving learning, in either direction. A4 Quiz was characterized as not relevant because that pattern is specific to the AI interrogating the human to verify or validate the human’s knowledge.

In our current research, we assume that users are correctly answering conceptual inquiries or request. The “A2+A3 Troubleshooting User-Initiated” pattern was assessed as not relevant for our use case. This pattern assumes that the user has a specified process to follow, of which the AI is aware. Within our use case of conceptual co-learning, there is no a priori process to follow as the engagement is targeted to be natural and conversational. However, “A3+A4 Teaching” is relevant and a core pattern to be considered because it encapsulates the agent teaching the user. It is our proposed extension to NCF to rename A3+A4 as “Teaching/Tutoring (Agent).”

We motivate this recommendation in three ways:

- In several instances, the NCF authors do call that pattern Tutoring instead of Teaching.
- Although Teaching and Tutoring are different, we anticipate the unit elements of conversations to be similar.
- We propose the addition of “(Agent)” because we anticipate the value of a reverse pattern, “Teaching/Tutoring (User)” whereby the user is the source of teaching and tutoring and the agent is the target of the learning.

Our review of the 24 sub-patterns of Conversational Activities identified 17 as relevant, three as not relevant, and four as possibly relevant. We omit details here due to space constraints. Beyond the current NCF patterns, we identified critical gaps and designed six new patterns to support co-learning:

- “Warrant Request & Acceptance” whereby the user questions the AI’s need-to-know for purposes of contextual understanding, and grants that input (this pattern is based off of A2.7).
- “Quiz by User” whereby the user quizzes the agent to verify its learning (as opposed to A4, ‘user being quizzed’).
- “Quiz by 3rd Party” whereby another component quizzes the AI (to enable multiple AI in multi-agent systems).
- “Inquiry (Agent) Typing Confirmed” (as a companion to A5.2) to account for the detection and repair of typos which are common in text-based conversational interfaces.
- “Inquiry (Agent) Typing Disconfirmed” (as a companion to A5.3) for a similar reason.
- “Teaching/Tutoring (User)” that aligns with the A3+A4 pattern but reverses the roles, as required for co-learning.

Conclusion, DOD Applications, and Future Work

- We foresee similar relevance in other war fighting functions, such as command and control or logistics.
- Future work will investigate the remaining NCF patterns and specify how they may apply to conceptual co-learning.
- We will further devise additional patterns needed and complete the decomposition of patterns into relevant conversational units.

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