

Proactive Conversational AI: A Comprehensive Survey of Advancements and Opportunities

Abstract (1 para)

- Dialogue systems usually focus on **reactive response-ability** (understanding and replying).
 - The missing piece: **proactivity** — agents that take initiative, anticipate outcomes, and guide conversations.
 - Defines proactive dialogue systems and surveys advancements in three categories:
 - **Open-Domain Dialogues (ODD)**,
 - **Task-Oriented Dialogues (TOD)**,
 - **Conversational Information-Seeking (CIS)**.
 - Covers **LLM-based challenges, hybrid dialogues, evaluation protocols, and ethics**
- 15.02. Proactive Conversational...
- .

Introduction (~6 paras)

- **Para 1–2:** Traditional dialogue systems = **reactive**. They wait for user input. Research has improved context understanding and response generation (e.g., GPT-2 → DialoGPT, BlenderBot).
- **Para 3:** Defines **proactive systems**: anticipate goals, initiate actions, plan strategically.
 - **Anticipation** (aim for outcomes: topics, positive emotions, tasks).
 - **Initiative** (shift topics, ask questions, provide suggestions).
 - **Planning** (design flow of conversation with strategies).
- **Para 4–5:** Proactivity boosts engagement, efficiency, autonomy → seen as a **step toward artificial consciousness**. Even ChatGPT struggles without it (e.g., giving

random guesses to vague queries).

- **Para 6:** Early work tried proactive topic shifts or suggestions. This survey organizes efforts into three dialogue categories (ODD, TOD, CIS).
 - **Para 7:** Gives examples:
 - ODD: target-guided dialogue (music → K-pop → Blackpink), emotional support (job loss), prosocial dialogues (handling cheating intention).
 - TOD: enriched with chit-chat or knowledge, sub-dialogues to resolve ambiguity, negotiation tasks.
 - CIS: clarifying questions (“TREC = Texas Real Estate Commission or Text Retrieval Conference?”), preference elicitation (“sneakers → for women/kids”), query management.
 - **Para 8:** Future issues → proactivity in LLMs, hybrid dialogues, evaluation protocols, ethics
- 15.02. Proactive Conversational...
- .

Preliminaries (~4 subsections)

- **ODD Systems:**
 - Aim: long-term social connection.
 - Subtypes:
 - *Topic-aware*: keep flow (user: “I love Blackpink” → system: talks about latest songs, concerts).
 - *Emotion-aware*: mirror emotions (user: “I got promoted” → system: “Congrats!”).
 - *Personalized*: align with persona (user likes animals → system responds consistently).

- Examples: DialoGPT (Reddit data), Meena (social media), BlenderBot (skills + blended datasets).
- **TOD Systems:**
 - Goal: accomplish concrete tasks (book tickets, reservations).
 - Subtasks: dialogue state tracking, policy learning, response generation.
 - Early systems = modular (error propagation issues).
 - Now end-to-end seq2seq → e.g., **Sequicity**, prompt-based PLMs
- **CIS Systems:**
 - Goal: satisfy info needs via multi-turn conversation.
 - Includes **CQA** (conversational Q&A), **conversational search**, **CRS** (recommendations).
 - Example: user asks “Who directed Inception?” → follows with “And The Dark Knight?” → system must rewrite into self-contained query.
 - Boundaries between CIS, TOD, ODD often blurred.
- **Systematic Review Process:**
 - Searched dblp.org for dialogue-related works (2018+).
 - Keywords: open-domain, task-oriented, clarification, proactive, etc.
 - Categorized into **nine proactive dialogue problems** (later sections expand).
 - Observations: Target-guided, emotional support, prosocial ODDs are trending. Clarification questions + preference elicitation in CIS also very active

Proactive ODDs (Section 3)

1. Target-Guided Dialogues

- Aim: steer conversation smoothly to a **hidden target** (system knows, user doesn't).
- Example: start with random topic → guide towards “Blackpink.”
- Subtasks: topic-shift detection, topic planning (using knowledge graphs, RL), topic-aware response generation.
- Datasets: TGC, DuConv, OTTers, TGConv.
- Evaluation: turn-level (smoothness, proactivity) + dialogue-level (success rate to hit target).

2. Emotional Support Dialogues

- Goal: **improve emotional state** (not just mirror feelings).
 - Methods:
 - Strategy prediction (joint learning, RL frameworks like READER).
 - Emotion cause analysis (graphs, commonsense knowledge).
 - Knowledge-augmented responses (e.g., HEAL knowledge graph).
 - Datasets: ESConv, HOPE, MI.
 - Evaluation: human annotators judge **identification, comforting, suggestion** quality
- 15.02. Proactive Conversational...
- .

3. Prosocial Dialogues

- Goal: correct unsafe or unethical utterances constructively.
- Methods:
 - Detection (offensive language classifiers, Judge-BERT).
 - Rules-of-Thumb (RoTs) → social norms like “People shouldn’t steal.”

- Prosocial response generation (datasets like SaFeRDialogues).
 - Example: user says “I want to cheat.” System → “That may hurt trust. Have you thought about resolving it honestly?”
 - Datasets: MIC, ProsocialDialog.
 - Evaluation: prosociality, respect, safety
- 15.02. Proactive Conversational...
- .

Proactive TODs (Section 4)

- **Enriched TODs:** add chit-chat or knowledge to make responses engaging. E.g., user books hotel → system adds “By the way, nearby restaurants are popular for seafood.”
 - **System-Initiated Sub-dialogues:** clarify ambiguity or handle complaints. Example: if multiple hotels match query → system asks: “Do you prefer closer to downtown or the beach?”
 - **Non-Collaborative Dialogues:** negotiation, persuasion, deception.
 - Example: CraigslistBargain dataset (buyer-seller price negotiation).
 - Example: P4G dataset (persuasion for charity donation).
 - Strategies: user modeling, strategy learning, persuasive response generation
- 15.02. Proactive Conversational...
- .

Proactive CIS (Section 5)

- **Clarification Questions:** handle ambiguous queries. (“trec” → which meaning?).
- **Preference Elicitation:** ask preferences in recommender systems (“Do you want sneakers for women or kids?”).
- **Over-Specified Query Management:** handle unanswerable or overly complex queries.

Datasets: Qulac, ClariQ, Abg-CoQA, PACIFIC, TREC CAsT.

Evaluation: human ratings, success rate of clarification, relevance of answers

15.02. Proactive Conversational...

.

Future Directions (Section 6–7)

- **Proactivity in LLMs:** current LLM-based systems (ChatGPT, etc.) still reactive. Need explicit strategies for initiative, planning.
- **Hybrid Dialogues:** mix ODD, TOD, CIS in one interaction → real-world complexity.
- **Evaluation Protocols:** must include psychology/sociology, not just BLEU or ROUGE.
- **Ethics:** proactive AI risks manipulation, over-influence, trust issues