

The Interaction Layer: An Exploration for Co-Designing User-LLM Interactions in Parental Wellbeing Support Systems

Abstract

- Frames the **problem**: 1 in 3 parents never seek support due to stigma, cost, lack of access.
 - AI offers promise: **stigma-free, affordable, scalable** support.
 - Issue: adoption fails because of **explainability and reliability gaps**.
 - Approach: Built *NurtureBot*, an LLM-based wellbeing assistant, **co-designed** with 78 parents.
 - Iterative trials (v1 → v2 → v3) show improvements in usability (CUQ score 91.3/100).
 - Contribution: An **Interaction Layer** — prompt architecture enabling parents to *understand, control, and improve* conversations in real time
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Introduction (~5 paras)

- Parenting is described as “*the most important job*” but one that takes a **huge toll**: stress, anxiety, isolation, especially in the **perinatal period**.
- Literature: barriers include **limited resources, stigma, professional shortages, COVID-19 disruptions**.
- HCI contributions: sleep tracking, screen-time apps, growth monitoring — but adoption low.
- With **ChatGPT and LLMs**, parents are already experimenting with AI for support. Potential: empathy, information, guidance. Concerns: **hallucination, lack of empathy, misinformation**.
- Sets **3 RQs**:

1. What problems do parents face when interacting with an LLM assistant?
 2. What user needs must such assistants address (ideal vision)?
 3. How can co-design improve usability/UX?
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Related Work (2 subsections)

1. Supporting Family Wellbeing with Digital Tools

- Long tradition in HCI (apps like *Baby Buddy*, bump2bump, peer support networks).
- Effectiveness depends on **alignment with parents' needs**.
- AI chatbots: Alexa, Siri → some adoption in homes.
- LLMs in parenting: rising but risky (bias, misinformation, data misuse).
- Retention issue: median 30-day retention of wellbeing apps = **3.3%**.

2. Interacting with AI for Everyday Users

- Non-experts rarely use **Explainable AI (XAI)**.
- Three pillars of human-centered AI: **understand, control, improve**.
- Need to design **cybernetic loop**: sensing → processing → reacting.
- Conversational UIs must handle **turn-taking, empathy, repair mechanisms**.
- Examples:
 - *ChaCha*: children expressing emotions via LLM.
 - *MindfulDiary*: psychiatric journaling support.
 - Postpartum depression narratives generated via GPT.

- Challenges: hallucinations, shallow empathy, regulatory risks

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Part I – NurtureBot v1: Initial Prototype

- **Origins:** Built on *Nurture Project* (peer-to-peer mentoring for new moms, ran 3 years, 603 parents). Successful but not scalable.
- **Design:** GPT-4 zero-shot prompt + curated resources. Features: empathetic chat, wellbeing exercises, parenting info.
- **Testing:** 32 parents (age ≈41, kids aged 5–6, chosen to minimize emotional risk). 5-day simulation (pregnancy → 6 months postpartum). Each day: 5–7 min interactions.
- **Data:** 144 conversations, 288 feedback entries. CUQ score = **85.4** (above 68 benchmark).
- **Findings (7 problems):**
 1. Cut-offs (redirecting to links).
 2. Patronizing/robotic tone.
 3. Non-localized resources.
 4. No memory.
 5. Generic link-spam.
 6. Transactional, not reflective.
 7. Overload of content

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Part II – ARC Co-Design Study

- **Method:** Asynchronous Remote Communities (ARC) with 32 parents on **Miro boards**. 91% participation.
- **Activity 1 (Prioritizing):** Parents ranked problems → Top 3 = (1) Cut-offs, (2) Non-localized resources, (3) Lack of memory.
- **Activity 2 (Solution Generation):** Parents role-played as *NurtureBot*, rewriting its dialogues in 3 scenarios: empathy chat, wellbeing exercise, baby soothing.
- **Results:** 189 parent-written dialogues → **7 user needs:**
 1. Use metaphors.
 2. Begin with empathy.
 3. Introduce features clearly.
 4. Step-by-step guidance.
 5. Personalize & deepen sessions.
 6. Clarify & reassure.
 7. Summarize & provide follow-ups

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Part III – The Interaction Layer: NurtureBot v2

- **Prompt Architecture:** Designed as **state machine** with:
 - Core principle: *Understand* → *Control* → *Improve*.
 - Interaction states: undecided, empathetic chatting, wellbeing exercises, parenting info.
 - Interaction levels: scaffolded with co-designed examples.
 - Interaction elements: contextual hints, reassurance, feedback loops.

- **Techniques:** Chain-of-Thought, ReAct prompting integrated.
- **Testing:** 32 parents again, 104 conversations. CUQ score = **87.2**.
- **Findings:**
 - Improvements in empathy, clarity.
 - Issues: long paragraphs, repetitive hints (“revise/restart/elaborate”).
 - Suggestions: multimodal features (images/videos), memory, community links

Part IV – NurtureBot v3 & Validation

- **Improvements:**
 - Responses capped at 50 words.
 - Contextual hints instead of generic.
 - Pre-output validation to check clarity.
- **Testing:** New cohort (46 parents, avg. age 38). 185 conversations, CUQ = **91.3**.
- **Findings:**
 - Parents praised flow, control, personalization.
 - Remaining gaps: desire for **multimodality** (images, videos), more detailed responses, deeper personalization.
 - Some parents still preferred traditional search engines over chatbot approach

Contributions

1. **Empirical:** Insights from 78 parents across 3 iterative trials, identifying **7 user needs** and recurrent pitfalls in LLM wellbeing support.
 2. **Design:** The **Interaction Layer** prompt architecture (understand–control–improve, states, levels, elements).
 3. **Implications:** Blueprint for future AI wellbeing tools in sensitive domains (parenting, healthcare, mental health).
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Conclusion

- NurtureBot demonstrates how **co-design + prompt engineering** can turn a generic LLM into a **domain-specific, parent-tested support agent**.
- The *Interaction Layer* is the key innovation: parents can **understand, control, improve** AI behavior in real time.
- Still open challenges: multimodal interaction, personalization, long-term adoption, safeguarding emotional wellbeing