Conversational AI Agents in Drive-Thrus: A User-Centered Perspective

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Abstract

The Quick Service Restaurant (QSR) industry is under constant pressure to improve operational efficiency and optimize in-store staffing, leading them to explore automated systems within hybrid human-AI teams. This study investigates QSR guests' and employees' perceptions of Conversational AI Agents in drive-thru food ordering settings through a series of field research studies with two QSR brands piloting the technology. Findings reveal generally positive guest experiences provided seamless human interventions when AI limitations arose, highlighting the importance of well-designed handoff mechanisms. While guests expressed concerns about job displacement, crew members viewed the AI as a tool for enhancing operational efficiency, underscoring the need for transparent communication about AI's impact on task distribution, and ensuring a balanced and collaborative approach. By prioritizing human-centered design principles, designers can create AI-driven solutions that enhance user adaptability to evolving AI capabilities and the overall QSR experience.

Keywords

Generative Artificial Intelligence, Conversational Artificial Intelligence, Quick Service Restaurants, Voice Interfaces, User Experience Research, Human-AI Teams

1. Introduction

The rapid advancement of conversational AI Agents, powerful LLM-driven programs that understand and respond to human language, is transforming daily life, with applications permeating both personal and professional spheres [1, 2]. Quick Service Restaurants (QSRs) are embracing this technological wave, exploring innovative solutions ranging from automated customer (or "guest") order-taking to personalized menu recommendations [3]. One particularly compelling use case is the deployment of Conversational AI Food Ordering AI Agents to facilitate drive-thru ordering, aiming to address labor shortages and optimize service speed [4, 5]. Google Cloud has piloted a Conversational Food Ordering AI Agent ("Food Ordering AI Agent") in two QSR enterprise customers. This Agent, implemented at the drive-thru screen, enables guests to interact with an AI to place their orders. The Food Ordering AI Agent is connected to the restaurant's menu data, supports multi-turn dialogues in English and Spanish, and generates responses using complex natural language processing though a transcription on a companion UI screen [Figure 1]. Human crew members listen to orders via a headset and remain available to intervene in cases of Agent error, complex requests, or guest preference. If the crew member needs to intervene, they simply activate their headset as they normally would to speak to the guest.

The introduction of such technology is poised to significantly impact the experiences of both guests and QSR employees. Therefore, an understanding of how these groups interact with and

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perceive this emerging technology is necessary for the development of a robust, effective and user-centered business application that ultimately enhances the QSR experience for everyone.

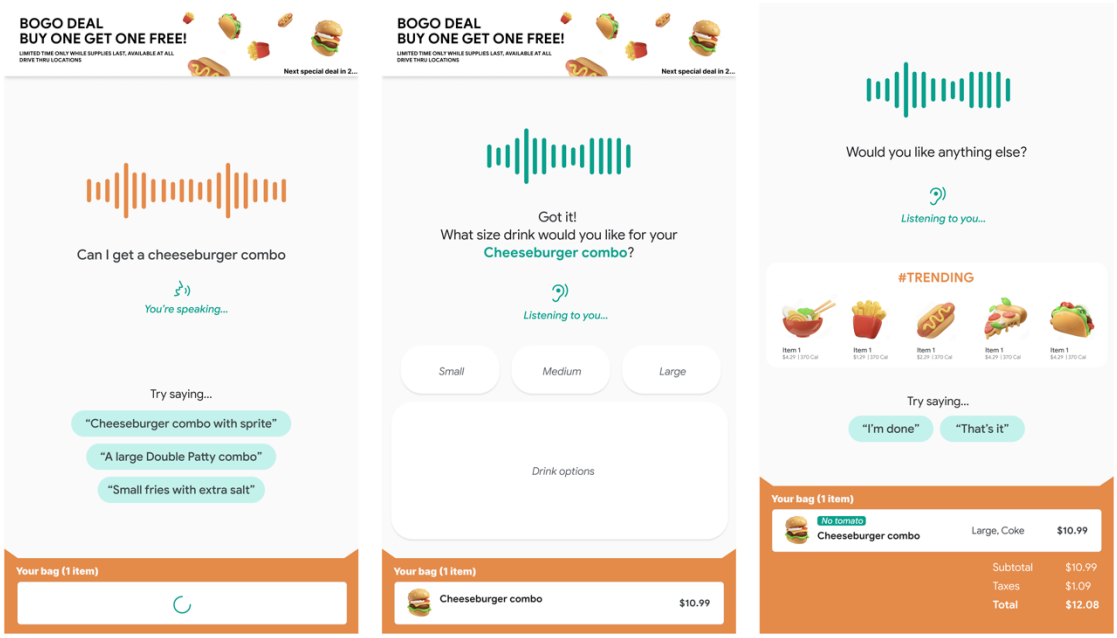

Figure 1. Conceptual mock-ups of a companion UI to the Food Ordering AI Agent displayed at the drive-thru speaker. The restaurant guest can refer to both the menu board and the companion UI during their ordering experience.

This paper presents findings from a series of field studies examining the real-world deployment of a Conversational Food Ordering AI Agent in QSR settings. We combined observational data of human-Agent interactions with insights gathered through interviews with both QSR employees and guests. Based on these findings, we outline key recommendations for the development of future Conversational AI Agents in the QSR industry.

2. Methods

The study was conducted as part of a larger Google Cloud pilot program with two different QSR brands in the United States, with the goal of understanding crew and guest pain points with the Food Ordering AI Agent and optimizing the Agent's implementation in drive-thru lanes. Three QSR restaurant site visits were conducted by a team of UX Researchers between November 2023 and December 2024. These visits encompassed two different states in the United States: Ohio and Florida where both guests and employees had been regularly interacting with the Food Ordering AI Agent as part of the ongoing pilot program. Each site visit comprised four key components:

1. Drive-Thru Observation: Researchers observed drive-thru operations, listening to guest-Agent interactions via headsets and observing crew members' workflows at both the drive-thru window and in the kitchen. Researchers noted guest and crew behaviors, common scenarios where a crew member had to intervene on an order ("interventions"), and Agent performance when handling real-world orders.

2. First-hand Ordering Experience: Researchers also placed orders with the Food Ordering AI Agent at two locations to evaluate the quality of the experience (e.g., where and how the Agent makes errors, clarity of the UI in-context, etc.)

3. Guest Intercept Interviews: Researchers conducted a total of 47 intercept interviews with drive-thru guests, particularly with guests who experienced challenges completing their order with the Agent, in order to identify pain points. Interviews explored guests' overall experiences with the drive-thru, including their perceptions of the Food Ordering AI Agent.

4. Crew Interviews: Semi-structured, individual interviews were conducted with 18 crew members and managers across different roles, including: Payment/Pick-up Window Staff (11), Shift Manager (5), District Manager (2). These interviews explored participants' roles and responsibilities, reasons for interventions, perceptions of the Agent, and suggestions for product improvements.

The research team conducted separate thematic analysis of both observational data and interview data for each QSR brand. The findings represent a synthesis of insights aggregated across all research activities, illustrating common behavioral patterns and perceptions of the Agent from both guests and QSR employees.

3. Findings

3.1. Positive perceptions despite Agent limitations

Drive-thru observations revealed that the majority of guests had a positive perception of the Food Ordering AI Agent. Participants frequently expressed surprise at the Food Ordering AI Agent's efficacy, stating that they were able to place their order quickly and accurately, and describing the interaction as "simple" and "straightforward." Guests noted a variety of benefits of the Food Ordering AI Agent, including reduced wait time at the speaker (because the Agent activates based on a sensor) and the Agent's undivided attention in contrast to a multi-tasking and at-times rushed employee.

This positive sentiment persisted among guests who experienced interventions. When crew members proactively intervened - for example to inform guests when an item was out of stock or if the Agent misunderstood a request - guests reported feeling satisfied with the overall experience. This suggests that human interventions and seamless handoffs between the AI Agent and human workers mitigated potential negative impacts of the Agent's limitations.

However, in a minority of scenarios, negative perceptions of the Food Ordering AI Agent arose when guests experienced friction in the handoff, such as requiring guests to repeat or completely redo their orders. These findings underscore the importance of efficient and unobtrusive intervention strategies in ensuring guest satisfaction.

3.2. Proactive and integrated rules of engagement with Agents

Repeat guests noted there was a learning curve to successfully navigating interactions with the Food Ordering AI Agent. Through experience, they discovered effective strategies for engaging with the Agent, such as stating only one item at a time and pausing between items to ensure the order was logged correctly. The lack of clear, visible instructions for using the Agent significantly hindered the guest experience. While physical signage existed at two locations, its placement away from the ordering screen rendered it unavailable when needed most. This, coupled with insufficient guidance within the user interface itself, led guests into a frustrating process of trial and error. This finding suggests taking a proactive approach to the Agent's usage instructions and directly integrating them into the user interface to facilitate smoother initial interactions with the Agent.

3.3. Disclosing the presence of human oversight

The majority of guests interviewed reported that they could easily identify that the Food Ordering AI Agent was powered by AI, even in the absence of explicit disclosure on the drive-thru's UI. The Agent's distinct tone of voice and the presence of on-screen transcriptions served as clear indicators of its artificial nature. Importantly, the user interface consistently informed guests of their ability to access a human crew member at any time. This assurance was highly valued by guests, who appreciated the option to seek assistance in case of errors or complications.

3.4. Differing guest and crew views on Agent's impact on labor

Despite the generally positive reception of the Agent, guests also expressed concerns about its potential impact on labor and employment. Some individuals voiced anxieties about job displacement, while others expressed a broader apprehension about the rapid advancement of technology, including a sense of inevitability regarding the infusion of AI experiences in daily life. This sentiment suggests potential challenges in ensuring a positive user experience across different user groups as AI-driven services become increasingly prevalent.

In contrast to guest apprehensions, crew members and management perceived the Food Ordering AI Agent as a valuable tool for enhancing operational efficiency. They cited frequent understaffing, especially during overnight shifts, and the pressure of multitasking across various responsibilities (e.g., managing the Point of Sale system, expediting orders, cleaning). Ultimately, while guests expressed concerns for job security and the role of Agents in QSR settings, crew and management saw the Food Ordering AI Agent as a much-needed solution to operational challenges, highlighting the need for proactive communication with the public to address perceptions and demonstrate the Agent's role in supporting, rather than replacing, human workers.

3.5. A perceived generation gap

While the study did not collect demographic data on age, interviews with crew and guests suggested a potential generational divide in the adoption of the Agent. Younger individuals appeared more receptive to the technology, with both guests and crew members commenting on youth's apparent adeptness and familiarity with voice interfaces. Similarly, there was a perception among the younger guests that older generations might encounter more challenges with the technology, suggesting a concern that the application of AI in this context could alienate older demographics and present a new barrier to drive-thru usage.

4. Recommendations

4.1. Establish proactive and seamless rules of engagement between users and Agent

The introduction of AI-driven ordering systems in QSRs changes established guest interaction patterns. Traditional ordering conventions, honed over years of practice, are no longer directly applicable to interactions with AI Agents. In contrast, as AI technology continues to evolve, so too will the optimal strategies for interacting with these systems. This dynamic nature presents a challenge for widespread adoption, emphasizing the need for ongoing education and tailored support to effectively engage with Food Ordering AI Agents across a diverse user base. A proactive approach in communicating the Food Ordering AI Agent's usage instructions integrated within user-friendly interfaces will be crucial in facilitating this transition and ensuring positive user experiences.

4.2. Design for the human-Agent handoff experience

While the initial focus of the AI Agent's UX design focused on the Agent's model quality, our findings highlight the critical importance of the transitions between the Agent and human crew members. This underscores the need to design with the handoff in mind. By prioritizing the design of the handoff process between humans and Agents, designers can create more robust and user-friendly hybrid Human-AI experiences, even in instances where the Agent encounters errors or limitations.

4.3. Empower interactions with Agents by providing a choice to interact with humans

Among the current discussions surrounding AI disclosure, there is a focus on informing guests that they are interacting with an AI Agent [6]. However, it is equally important to explore the potential benefits of disclosing the presence of human oversight. Informing guests that a human is monitoring the interaction can serve multiple purposes. Firstly, it reinforces the availability of human assistance in case of errors or complexities, providing reassurance and a sense of security. Secondly, it empowers guests with the choice to speak to a human, potentially alleviating feelings of technological alienation and ensuring equitable access for individuals across varying levels of technological comfort.

4.4. Show where labor is being redistributed

While the implementation of Food Ordering AI Agent in QSRs aims to optimize workflows and alleviate crew burden rather than replace jobs, negative guest perceptions regarding potential job displacement could hinder adoption. Human crew members remain essential for tasks such as payment processing and order confirmation, highlighting the collaborative nature of the AI's integration. However, addressing guest concerns about labor impact, especially AI's role in task distribution, is crucial for successful integration of this technology.

Demonstrating how the design of Food Ordering AI Agents fosters a redistribution of labor through hybrid human-AI collaboration - rather than outright job elimination - can help alleviate guests' anxieties. Transparency regarding the ways in which Food Ordering AI Agents empower crew members to focus on higher-level tasks, improve customer service, and enhance overall efficiency can foster a more positive perception of this technological shift.

5. Future Directions

5.1. Further explore users' diverse needs

While preliminary observations suggest potential generational disparities in user perceptions and adoption of the Food Ordering AI Agent, further investigation is needed to avoid generalizations and potential biases. To ensure equitable access and user experience across all demographics, future research should delve deeper into the nuanced factors influencing user interactions with AI Agents. This includes exploring individual preferences, technological literacy, and potential anxieties surrounding automation across age groups. A comprehensive understanding of these diverse needs will enable the development of inclusive and user-centered AI technologies.

5.2. Further explore the impact of a "human-in-the-loop"

While guests were informed of the ability to speak to a crew member at any time in the conversation, the UI did not explicitly state that a crew member was passively monitoring all Agent interactions. Not knowing that there was a human-in-the-loop may have led to a variety of guest

behaviors. For example: leaving out modifications due to lack of confidence in the Agent's abilities, or pushing the Agent's limits by knowingly ordering items that are not sold by the QSR.

Further research is needed to explore how disclosing human oversight impacts guest behavior, comfort, and satisfaction with the Agent, and if a clear disclosure of human monitoring could improve the rate of order success.

6. Conclusion

The findings presented in this paper underscore the critical importance of incorporating human-centered design principles in the development and implementation of AI Agents in real-world workforce settings. While AI technology offers significant potential for optimizing efficiency and guest experience, it is crucial to acknowledge and address the multifaceted impact on the people involved.

This research highlights the need for greater transparency and communication regarding automations that complement human capabilities in hybrid human-AI teams. Clearly conveying the value proposition of AI Agents, both for guests and employees, is essential for fostering trust and acceptance. Furthermore, designers must prioritize seamless human-AI handoff mechanisms and address the diverse needs of individuals to ensure equitable access and user satisfaction.

By integrating these human-centered considerations into the design process, organizations can create AI-driven solutions that enhance the overall QSR experience for all users, promoting a harmonious collaboration between humans and technology. Future research should continue to explore the evolving dynamics between AI and human interaction, informing the development of inclusive and user-friendly AI technologies.

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Declaration on Generative AI

During the preparation of this work, the author(s) used Google Gemini 2.0 in order to: Draft content. After using these tool(s)/service(s), the author(s) reviewed and edited the content as needed and take(s) full responsibility for the publication's content.

References

[1] Deloitte. 2024. Autonomous generative AI agents: Under development. (November 19, 2024). Retrieved January 28, 2025 from https://www2.deloitte.com/us/en/insights/industry/technology/technology-media-and-telecom-predictions/2025/autonomous-generative-ai-agents-still-under-development.html

[2] A. Bick, A. Blandin, and D. J. Deming. 2024. *The Rapid Adoption of Generative AI.* National Bureau of Economic Research, Cambridge, MA. https://doi.org/10.3386/w32966

[3] N. Sahota. 2024. AI In The Fast Lane: Revolutionizing Fast Food Through Technology. (March 5, 2024). Forbes. Retrieved January 28, 2025 from https://www.forbes.com/sites/neilsahota/2024/03/05/ai-in-the-fast-lane-revolutionizing-fast-food-through-technology/

[4] NBC News. 2025. Fast food goes high tech with new A.I. drive-thrus. Video. (January 26, 2025). Retrieved January 28, 2025 from https://youtu.be/osvVHE9l_IE?si=MP-aO2H9nfRc503s

[5] J. Kell. 2024. Inside Wendy's drive-thru AI that makes ordering fast food even faster. (October 15, 2024). Fortune. Retrieved January 28, 2025 from https://fortune.com/2024/10/15/wendy-google-ai-drive-thru-expansion/

[6] E. M. Renieris, D. Kiron, and S. Mill. 2024. Artificial Intelligence Disclosures Are Key to Customer Trust. (September 24, 2024). MIT Sloan Management Review. Retrieved January 29, 2025 from https://sloanreview.mit.edu/article/artificial-intelligence-disclosures-are-key-to-customer-trust/