

# Empathy Beyond Accuracy: Reinterpreting User Understanding in the Age of Large Language Models

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## Abstract

Empathy is considered as a cornerstone of user-centered product design, enabling designers to understand users' experiences and create meaningful solutions. However, empirical research shows that empathic understanding in design is inherently incomplete, inconstant, and shaped by interpersonal and contextual factors. Rather than accurate perspective-taking, empathy functions as a dynamic, situated, and interpretive process that influences how designers construct meaning and make decisions. The emergence of Large Language Models (LLMs) reconfigures this process. LLMs can simulate user perspectives, generate personas, and synthesize narratives at unprecedented speed. While this appears to enhance empathic capability, it also risks creating an illusion of completeness by conflating linguistic plausibility with genuine understanding. AI-mediated empathy introduces new epistemic and ethical challenges, redistributing interpretation across human-AI-user systems and compressing the temporal development of empathic engagement. Building on empirical insights into empathic incompleteness, this paper examines how LLMs transform empathy from relational engagement into technologically mediated simulation. We argue that empathy should be understood not as a static skill to be optimized, but as a dynamic process continuously reshaped by technological tools in human-centered product design and development.

## Keywords

Empathy, Empathic understanding, Product design and development, LLM

## 1. Empathy Beyond Accuracy

Empathy has long been considered a cornerstone of user-centered product design and development (Mattelmäki, Vaajakallio, Koskinen, 2014). This is because we are humans, and we design for humans. Human experiences are complex, dynamic, and context-dependent. Whether we can understand users accurately will directly influence whether the design outcomes can fulfill users' needs. In human-centered product design and development, empathy is commonly defined as the capacity to understand and relate to users' experiences, emotions, and perspectives, enabling designers to create products that are meaningful, usable, and socially responsible (Surma-aho Hölttä-Otto, 2022). Within design thinking, participatory design, and human-centered engineering design, empathy is treated as both a methodological commitment and a professional design toolkit (Kouprie Visser, 2009; Chang-Arana, Surma-aho, Hölttä-Otto, Sams, 2022).

However, previous design studies challenge the simplified interpretations of empathy as accurate perspective-taking. Empirical investigations into empathic understanding in design contexts demonstrate that empathic understanding is always incomplete and inconstant (Li Hölttä-Otto, 2023). Designers do not—and cannot—fully capture users' internal states. Empathic understanding accuracy varies significantly depending on interpersonal differences, cognitive styles, prior experience, and contextual constraints (Li, 2022). Even under carefully structured research conditions, empathic alignment fluctuates across individuals and situations. These findings shift the focus from empathy as “correct representation” to empathy as a dynamic, situated, and probabilistic process (Li Hölttä-Otto, 2023). Rather

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than asking whether designers perfectly understand users, the more meaningful question becomes: how does empathic engagement shape the quality of interpretation and decision-making in human-centered product design and development? Although complete empathic accuracy is unattainable, abandoning empathy would be a mistake. Research shows that maintaining empathy as a mindset—a deliberate orientation toward understanding others—significantly narrows the experiential distance between designers and users (Bennett Rosner, 2019). Even partial or imperfect empathy facilitates more in-depth needfinding, reduces egocentric projection, and increases sensitivity to contextual nuances (McDonagh Thomas, 2010; Li Hölttä-Otto, 2022).

In human-centered product design and development, empathy has been operationalized through ethnographic methods, interviews, personas, journey maps, co-design sessions, and experience prototyping (McDonagh, 2006; Smeenk, Sturm, Eggen, 2018). These tools do not provide direct access to the minds of users; rather, they structure interpretation. These methods provide interpretive scaffolds that encourage designers to question assumptions and attend to users' lived experiences. Importantly, successful design outcomes do not emerge from fully capturing users' thoughts. Instead, they arise when designers intelligently re-create aspects of user experiences and generate valuable interpretations on top of them (Kouprie Visser, 2009). Empathy thus functions not as replication, but as interpretive transformation. Designers synthesize fragmented insights into coherent, future-oriented solutions. The quality of design lies not in mirroring users, but in meaningfully extending their experience (Drouet, Sleeswijk Visser, Pagán, Lallemand, 2024). This reframing has profound implications: empathy in design is not about accuracy alone, but about the productive tension between understanding and creative interpretation.

The emergence of Large Language Models (LLMs) fundamentally alters the landscape in which empathy operates (Zhu, Chong, Yang, Luo, 2024). LLMs can generate fluent, emotionally resonant, and context-sensitive language that simulates perspective-taking (Zhu Luo, 2024). They can summarize interviews, generate personas, suggest user narratives, and articulate stakeholder viewpoints at unprecedented speed and scale (Das, Li, Fabunmi, Hölttä-Otto, 2026).

At first glance, this appears to enhance designers' empathic capability. However, when situated against the empirical finding that empathy is inherently incomplete and inconstant, LLMs introduce new epistemic, ethical complexities and errors in judging designers' empathic abilities (Fabunmi, Halgamuge, Beck, Holttä-Otto, 2025). First, LLMs simulate empathic expression without experiential grounding. If human empathy is already partial and probabilistic, AI-generated empathy may amplify the illusion of completeness. Designers may conflate linguistic plausibility with authentic understanding (Fabunmi, Halgamuge, Beck, Holttä-Otto, 2025). This risk reinforces overconfidence in synthesized user representations. Second, interpersonal differences—previously identified as a major source of variation in empathic accuracy—become reconfigured. Instead of designer–user differences alone, we now confront designer–AI–user triangulations. Whose interpretation is represented? Whose biases are embedded in the training data? How do algorithmic generalizations reshape contextual nuance (Cuadra, et al., 2024)? Third, if successful design depends on intelligent reinterpretation rather than perfect capture, the role of AI becomes ambiguous. Does AI support designers in generating richer interpretations, or does it prematurely stabilize and standardize user representations? Does it narrow experiential distance, or does it create a new layer of mediation that distances designers from real-world encounters (Yu, et al., 2025)? Finally, the availability of instant empathic simulation challenges the temporal dimension of empathy. Human empathic understanding develops over time through exposure, interpersonal dialog, and reflection (Tracey Baaki, 2022). AI systems compress this process into an immediate output. This acceleration may reshape how empathy is practiced, valued, and institutionalized in product development.

Building on empirical findings that empathy is incomplete, situated, and interpretive, it is necessary to examine how LLMs reconfigure the nature of empathic understanding in user-centered design. Rather than asking whether AI can “achieve” empathy, it is also important to investigate how the nature of empathy is transformed as it becomes: 1) Distributed across human–AI collaboration; 2) Mediated by technological affordances; 3) Reframed from relational engagement to generative simulation; and 4) Transformed in its contextual grounding, intentional orientation, and temporal unfolding. By integrating

empirical insights on empathic accuracy with theoretical inquiry into technological mediation, we suggest a more nuanced understanding of empathy—not as a static skill to be optimized, but as a dynamic process continuously reshaped by the tools through which designers engage with users.

## 2. Rethinking Empathy in AI-Mediated Design

Recent work on artificial empathy has primarily focused on enabling AI systems to computationally model components of empathic understanding to support human-centered design. For example, Zhu and Luo (2024) proposed an Artificial Empathy Framework that decomposes empathy into computationally tractable modules, providing a foundation for AI-assisted user understanding and need discovery. Such work represents an important step toward operationalizing empathy within intelligent design systems.

However, the emergence of large language models suggests that the research agenda should move beyond asking whether AI can computationally approximate empathy. As AI increasingly participates in observing, interpreting, reasoning about, and communicating user experiences, empathy itself becomes a socio-technical phenomenon rather than an exclusively human capability (Zhu, Chong, Yang, & Luo, 2025). In this context, empathy is no longer produced solely through the designer’s direct engagement with users, but increasingly emerges through interactions among designers, users, and AI systems (Zhu & Luo, 2023).

This perspective complements existing research on artificial empathy by shifting the focus from building empathic AI to understanding AI-mediated empathy. Rather than evaluating AI according to how closely it reproduces human empathic processes, future research should investigate how intelligent technologies reshape the practice of empathy itself. Empathy may become distributed across human–AI collaboration, mediated by computational representations, reframed through generative simulation, and continuously reconstructed through iterative interactions between humans and intelligent systems. From this perspective, artificial empathy is not simply an engineering objective but also a catalyst for rethinking the theoretical foundations of empathy in human-centered design.

## 3. Ethical Considerations for Artificial Empathy

The increasing use of artificial empathy also raises important ethical considerations that extend beyond technical performance. As AI systems become capable of interpreting emotions, inferring user intentions, and generating empathic responses, designers must carefully consider how such capabilities are developed and deployed. Unlike traditional design tools, artificial empathy relies heavily on personal data, behavioral traces, conversational histories, and contextual information, creating issues of privacy, informed consent, and data governance central to its responsible use. For example, Votintseva et al. (2025) show that empathic AI agents can improve industrial interactions, but they also raise questions about trust, transparency, and users’ perceptions of AI personas. The collection and interpretation of increasingly intimate user information should therefore be accompanied by transparent data practices and clear ethical boundaries.

Beyond privacy, artificial empathy also challenges fundamental assumptions about the nature of empathic relationships. While AI may successfully simulate empathic behavior, such simulations should not be conflated with genuine human empathy. Shteynberg et al. (2024) summarized in recent discussions on empathic AI that the ethical implications lie not in whether AI truly “feels” empathy, but in how simulated empathy influences human trust, expectations, and decision-making. Designers are responsible for ensuring that empathic AI supports, rather than manipulates, users’ emotional experiences.

Finally, an over-reliance on AI-generated interpretations may unintentionally obscure the uniqueness of individual users. Large language models infer likely interpretations based on statistical regularities learned from data, whereas human-centered design seeks to understand people whose experiences often diverge from these patterns. As Kidder et al. (2024) argue, “*empathy is a uniquely human method of honoring the right to be an exception*” (p. 9). This perspective reminds us that meaningful design cannot

rely solely on generalized predictions but must remain open to unexpected perspectives, evolving contexts, and the richness of individual lived experiences. These ethical considerations reinforce our argument that artificial empathy should augment, rather than replace, direct human engagement in the design process.

## 4. The Enduring Role of Human Engagement in Human-Centered Design

As AI continues to reshape design practice, the discussion should move beyond whether intelligent systems can support empathic understanding toward how these capabilities can be responsibly integrated into human-centered design. In this paper, we argue that empathy should be understood as a dynamic, relational, and evolving process that is increasingly mediated by intelligent technologies. The emergence of artificial empathy offers new opportunities to broaden designers' perspectives, stimulate reflection, and support user understanding, while simultaneously raising important ethical questions regarding privacy, transparency, human agency, and the responsible use of personal data.

At the same time, the future of empathy in design should not be characterized by an increasing dependence on AI. Rather, it should be guided by thoughtful collaboration between human designers and intelligent technologies. While AI can reveal patterns, generate alternative interpretations, and augment empathic reasoning, it cannot replace the value of engaging directly with the people for whom we design. Human experiences are dynamic, contextual, and continuously evolving, and meaningful empathy emerges through interaction, dialogue, and the co-construction of understanding rather than through computational inference alone.

Ultimately, the goal of artificial empathy should not be to reduce the role of designers in understanding people, nor to replace human relationships with algorithmic predictions. Instead, it should empower designers to engage with users more deeply, reflect more critically, and design more responsibly. As AI becomes an increasingly integral part of design practice, preserving meaningful human engagement will remain essential—not despite the advancement of artificial empathy, but precisely because empathy is, at its core, a human-centered and relational practice.

## Declaration on Generative AI

During the preparation of this work, the author(s) used **ChatGPT (GPT-5.5)** for grammar checking and language polishing. After using this tool, the author(s) carefully reviewed and edited the content as needed and take full responsibility for the content of the publication.

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