

Best Practices and Primary Limitations of N-of-1 and Auto-ethnographic Methods in HCI Research

1. Introduction

N-of-1 and auto-ethnographic methods have become increasingly prominent in Human-Computer Interaction (HCI) research, offering unique insights into individual experiences, personalized interventions, and the nuanced interplay between humans and technology. N-of-1 methods, rooted in single-case experimental designs, allow for rigorous within-person analysis and are particularly valuable for studying heterogeneous effects, rare conditions, or personalized technology use (Porcino et al., 2020; McDonald et al., 2017; Shamseer et al., 2015; Duan et al., 2013; Gabler et al., 2011; Kwasnicka et al., 2019; Hawksworth et al., 2024; Chatters et al., 2024). Auto-ethnography, on the other hand, leverages the researcher's own lived experience to generate deep, reflexive understanding of technology adoption, design, and use, often surfacing marginalized perspectives and challenging dominant paradigms (McDonald et al., 2019; Arya, 2024; Erete et al., 2021; Lucero et al., 2021; Kaltenhauser et al., 2024; Lucero et al., 2019). Best practices for both approaches emphasize methodological transparency, reflexivity, robust data collection, and clear reporting standards (McDonald et al., 2019; Porcino et al., 2020; Shamseer et al., 2015; Lucero et al., 2021; Kaltenhauser et al., 2024; Chatters et al., 2024). However, these methods also face notable limitations, including concerns about generalizability, potential for bias, challenges in reliability and validity, and practical barriers to implementation in broader HCI contexts (McDonald et al., 2019; McDonald et al., 2017; Erete et al., 2021; Kwasnicka et al., 2019; He et al., 2021; Kaltenhauser et al., 2024; Wilmont et al., 2024; Lucero et al., 2019). This review synthesizes established best practices and primary limitations, drawing on recent systematic reviews, methodological guidelines, and empirical studies in HCI and related fields.

2. Methods

We searched over 170 million research papers in Consensus, including Semantic Scholar, PubMed, and other major databases, using targeted queries on N-of-1 and auto-ethnographic methods in HCI. A total of 992 papers were identified, 642 were screened, 340 were deemed eligible, and the 50 most relevant papers were included in this review.

Search Strategy



FIGURE 1 Flow diagram of the literature search and selection process.

Eight unique search groups were executed, covering foundational frameworks, best practices, limitations, interdisciplinary perspectives, and methodological diversity in N-of-1 and auto-ethnographic HCI research.

3. Results

3.1. Best Practices for N-of-1 Methods in HCI

- **Rigorous Design and Protocols:** Use randomization, blinding, and formal outcome assessment where possible to enhance internal validity (Porcino et al., 2020; Shamseer et al., 2015; Duan et al., 2013; Hawsworth et al., 2024; Chatters et al., 2024). Employ established reporting guidelines such as SPENT (SPIRIT extension for N-of-1 trials) and CENT (CONSORT extension for N-of-1 trials) to ensure transparency and completeness (Porcino et al., 2020; Shamseer et al., 2015; Chatters et al., 2024; , 2016).
- **Appropriate Statistical Analysis:** Account for serial correlation, carryover effects, and individual variability using advanced statistical models (e.g., dynamic regression, Bayesian approaches) (Vieira et al., 2017; Percha et al., 2019; Araujo et al., 2016; Shrestha & Jain, 2021; Senn, 2024; Tang & Landes, 2019; Diaz, 2021).
- **Personalization and Relevance:** Tailor interventions and measurements to the individual, leveraging digital tools and mobile health platforms for real-time, unobtrusive data collection (McDonald et al., 2017; Konigorski et al., 2020; Kravitz et al., 2020).
- **Ethical Considerations:** Ensure informed consent, participant autonomy, and clear communication of risks and benefits, especially when interventions are highly personalized (Porcino et al., 2020; Duan et al., 2013; Wilmont et al., 2024; Chatters et al., 2024).

3.2. Best Practices for Auto-ethnographic Methods in HCI

- **Reflexivity and Transparency:** Maintain a reflexive stance, explicitly acknowledging the researcher's positionality, biases, and influence on the research process (Mcdonald et al., 2019; Arya, 2024; Erete et al., 2021; Lucero et al., 2021; Kaltenhauser et al., 2024; Lucero et al., 2019).
- **Thick Description and Rich Data:** Provide detailed, context-rich narratives that connect personal experience to broader cultural, social, or technological phenomena (Arya, 2024; Erete et al., 2021; Lucero et al., 2021; Kaltenhauser et al., 2024).
- **Methodological Rigor:** Use systematic data collection (e.g., diaries, logs, artifacts), iterative analysis, and triangulation where possible to enhance credibility (Mcdonald et al., 2019; Lucero et al., 2021; Kaltenhauser et al., 2024).
- **Clear Reporting Standards:** Follow established guidelines for reporting auto-ethnographic work, including transparency about methods, data, and analytic choices (Mcdonald et al., 2019; Kaltenhauser et al., 2024; Lucero et al., 2019).

3.3. Primary Limitations of N-of-1 and Auto-ethnographic Methods

- **Generalizability:** Findings are often limited to the individual or context studied, making it difficult to generalize to broader populations (Mcdonald et al., 2019; McDonald et al., 2017; Erete et al., 2021; Kwasnicka et al., 2019; He et al., 2021; Kaltenhauser et al., 2024; Wilmont et al., 2024; Lucero et al., 2019).
- **Potential for Bias:** Researcher and participant biases can influence data collection, interpretation, and reporting, especially in auto-ethnography (Mcdonald et al., 2019; Arya, 2024; Erete et al., 2021; Lucero et al., 2021; Kaltenhauser et al., 2024; Lucero et al., 2019).
- **Reliability and Validity:** Challenges in establishing reliability (e.g., inter-rater reliability is rare in qualitative HCI research) and validity due to subjective interpretation and lack of replication (Mcdonald et al., 2019; Lucero et al., 2021; Kaltenhauser et al., 2024; Lucero et al., 2019).
- **Practical Barriers:** N-of-1 studies can be time-consuming, require specialized statistical expertise, and may face logistical challenges in recruitment and retention (McDonald et al., 2017; Kwasnicka et al., 2019; He et al., 2021; Wilmont et al., 2024; Chatters et al., 2024).
- **Ethical and Relational Issues:** Auto-ethnography may expose sensitive personal information, raising concerns about privacy, consent, and potential harm (Erete et al., 2021; Kaltenhauser et al., 2024; Lucero et al., 2019).

3.4. Emerging Solutions and Opportunities

- **Mixed Methods and Aggregation:** Combining N-of-1 and auto-ethnographic approaches with other qualitative or quantitative methods can enhance robustness and transferability (Van Ness et al., 2017; Perski et al., 2019).
- **Digital Platforms and Tools:** New digital platforms (e.g., StudyU) facilitate the design, conduct, and reporting of N-of-1 studies, lowering barriers to entry (Konigorski et al., 2020; Chatters et al., 2024).
- **Community and Participatory Approaches:** Engaging participants as co-researchers and leveraging community-based auto-ethnography can broaden perspectives and increase impact (Erete et al., 2021; Kaltenhauser et al., 2024; Lucero et al., 2019).

Key Papers

Paper	Methodology	Key Focus	Best Practices Highlighted	Limitations Discussed
(Porcino et al., 2020)	SPENT guideline	N-of-1 trials	Protocol transparency, stakeholder consensus, reporting standards	Implementation complexity
(Shamseer et al., 2015)	CENT guideline	N-of-1 trials	Reporting completeness, checklist for transparency	Variable reporting quality
(Mcdonald et al., 2019)	Meta-analysis & guidelines	Qualitative/auto-ethnography in HCI	Reliability, reflexivity, reporting norms	Rare use of IRR, subjectivity
(Kaltenhauser et al., 2024)	Systematic review	Auto-ethnography in HCI	Data collection, thick description, reporting	Generalizability, bias
(Chatters et al., 2024)	Stakeholder workshop	N-of-1 trials	22 key design points, stakeholder input	Design and implementation barriers

FIGURE 2 Comparison of key studies on best practices and limitations of N-of-1 and auto-ethnographic methods in HCI.

Top Contributors

Type	Name	Papers
Author	Larissa Shamseer	(Porcino et al., 2020; Shamseer et al., 2015; Porcino et al., 2017)
Author	S. Vohra	(Porcino et al., 2020; Shamseer et al., 2015; Gabler et al., 2011; , 2016; Nikles et al., 2011; Kravitz et al., 2009)
Author	J. Nikles	(Shamseer et al., 2015; Scuffham et al., 2010; Nikles et al., 2005)
Journal	<i>Trials</i>	(Hawthornth et al., 2024; Chatters et al., 2024)
Journal	<i>Proceedings of the ACM on Human-Computer Interaction</i>	(Mcdonald et al., 2019; Erete et al., 2021)
Journal	<i>Health Psychology Review</i>	(McDonald et al., 2017; Vieira et al., 2017; Kwasnicka et al., 2019)

FIGURE 3 Authors & journals that appeared most frequently in the included papers.

4. Discussion

N-of-1 and auto-ethnographic methods offer powerful tools for advancing personalized, context-rich, and reflexive research in HCI. The adoption of standardized guidelines (e.g., SPENT, CENT) and best practices around transparency, reflexivity, and methodological rigor has improved the quality and credibility of these approaches (Mcdonald et al., 2019; Porcino et al., 2020; Shamseer et al., 2015; Kaltenhauser et al., 2024; Chatters et al., 2024). However, persistent limitations—such as limited generalizability, potential for bias, and practical barriers—underscore the need for careful design, clear reporting, and critical reflection (Mcdonald et al., 2019; McDonald et al., 2017; Erete et al., 2021; Kwasnicka et al., 2019; Kaltenhauser et al., 2024; Wilmont et al., 2024; Lucero et al., 2019). The field is moving toward greater methodological pluralism, with mixed methods, digital platforms, and participatory approaches offering promising avenues to address these challenges (Konigorski et al., 2020; Chatters et al., 2024; Van Ness et al., 2017; Perski et al., 2019). Ultimately, the value of N-of-1 and auto-ethnographic research in HCI lies in their ability to surface individual and marginalized experiences, inform personalized interventions, and challenge dominant narratives—provided their limitations are acknowledged and addressed.

Claims and Evidence Table

Claim	Evidence Strength	Reasoning	Papers
Standardized guidelines (SPENT, CENT) improve transparency and rigor in N-of-1 trials	 Strong	Widely adopted, consensus-based guidelines with demonstrated impact on reporting quality	(Porcino et al., 2020; Shamseer et al., 2015; Chatters et al., 2024; , 2016)
Reflexivity and thick description are essential for credible auto-ethnography in HCI	 Strong	Systematic reviews and methodological papers emphasize reflexivity and rich data as core strengths	(Mcdonald et al., 2019; Arya, 2024; Erete et al., 2021; Lucero et al., 2021; Kaltenhauser et al., 2024; Lucero et al., 2019)
Generalizability is a primary limitation of both N-of-1 and auto-ethnographic methods	 Moderate	Multiple reviews and empirical studies highlight limited transferability of findings	(Mcdonald et al., 2019; McDonald et al., 2017; Erete et al., 2021; Kwasnicka et al., 2019; He et al., 2021; Kaltenhauser et al., 2024; Wilmont et al., 2024; Lucero et al., 2019)
Reliability and validity are challenging to establish, especially in qualitative/auto-ethnographic work	 Moderate	IRR is rare; subjectivity and lack of replication are common concerns	(Mcdonald et al., 2019; Lucero et al., 2021; Kaltenhauser et al., 2024; Lucero et al., 2019)
Digital tools and mixed methods can help address some limitations	 Moderate	Emerging platforms and methodological pluralism show promise for enhancing robustness	(Konigorski et al., 2020; Chatters et al., 2024; Van Ness et al., 2017; Perski et al., 2019)
Ethical and practical barriers (e.g., privacy, time, expertise) remain significant	 Moderate	Stakeholder input and qualitative studies highlight ongoing challenges	(Erete et al., 2021; Kwasnicka et al., 2019; Kaltenhauser et al., 2024; Wilmont et al., 2024; Chatters et al., 2024; Lucero et al., 2019)

FIGURE 4 Key claims and support evidence identified in these papers.

5. Conclusion

N-of-1 and auto-ethnographic methods are valuable for advancing personalized, reflexive, and context-sensitive research in HCI, but require careful attention to methodological rigor, transparency, and ethical considerations to address their inherent limitations.

5.1. Research Gaps

Key gaps include the need for more robust strategies to enhance generalizability, improved methods for establishing reliability and validity, and greater integration of digital tools and participatory approaches.

Research Gaps Matrix

Method/Focus	Generalizability	Reliability/Validity	Digital Tools	Mixed Methods	Participatory Design
N-of-1 Trials	7	6	4	5	2
Auto-ethnography	8	7	3	4	3

FIGURE 5 Heatmap of research coverage by method and study attribute.

5.2. Open Research Questions

Future research should focus on enhancing generalizability, developing robust reliability/validity strategies, and leveraging digital and participatory methods to strengthen N-of-1 and auto-ethnographic research in HCI.

Question	Why
How can findings from N-of-1 and auto-ethnographic studies be synthesized or generalized to inform broader HCI practice?	Addressing this would increase the impact and applicability of individualized research in the field.
What new strategies can improve reliability and validity in auto-ethnographic and first-person HCI research?	Enhancing rigor will strengthen the credibility and acceptance of these methods.
How can digital platforms and participatory approaches be leveraged to scale and democratize N-of-1 and auto-ethnographic research in HCI?	This could lower barriers, increase inclusivity, and improve methodological robustness.

FIGURE 6 Open research questions and their significance for future work.

In summary, while N-of-1 and auto-ethnographic methods offer unique strengths for HCI research, addressing their limitations through methodological innovation and critical reflection is essential for maximizing their value and impact.

These papers were sourced and synthesized using Consensus, an AI-powered search engine for research. Try it at <https://consensus.app>

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