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A Scoping Review

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Situating Empathy in HCI/CSCW: A Scoping Review

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Empathy is considered a crucial construct within HCI and CSCW, yet our understanding of this complex concept remains fragmented and lacks consensus in existing research. In this scoping review of 121 articles from the ACM Digital Library, we synthesize the diverse perspectives on empathy and scrutinize its current conceptualization and operationalization. In particular, we examine the various interpretations and definitions of empathy, its applications, and the methodologies, findings, and trends in the field. Our analysis reveals a lack of consensus on the definitions and theoretical underpinnings of empathy, with interpretations ranging from understanding the experiences of others to an affective response to the other's situation. We observed that despite the variety of methods used to gauge empathy, the predominant approach remains self-assessed instruments, highlighting the lack of novel and rigorously established and validated measures and methods to capture the multifaceted manifestations of empathy. Furthermore, our analysis shows that previous studies have used a variety of approaches to elicit empathy, such as experiential methods and situational awareness. These approaches have demonstrated that shared stressful experiences promote community support and relief, while situational awareness promotes empathy through increased helping behavior. Finally, we discuss *a)* the potential and drawbacks of leveraging empathy to shape interactions and guide design practices, *b)* the need to find a balance between the collective focus of empathy and the (existing and dominant) focus on the individual, and *c)* the careful testing of empathic designs and technologies with real-world applications.

CCS Concepts: • **Human-centered computing** → **HCI theory, concepts and models**; *HCI design and evaluation methods.*

Additional Key Words and Phrases: Empathy, Empathy-Centric Design, Scoping Review

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1 Introduction

The concept of empathy and empathy-centric design has received considerable attention in recent years in the field of Human-Computer Interaction (HCI) and Computer-Supported Cooperative Work (CSCW) [12, 103, 127, 169]. Particularly, empathy has been recognized not only for its potential to significantly improve user engagement but also as a mediator for fine-grained understanding of the end-users [12].

The dominant discourses on empathy in HCI/CSCW and its relation to design are being critically examined, as evidenced by the organization of three consecutive workshops at CHI in 2022-2024 [40, 43, 103]. Besides seeking to critically assess and clarify the notion of empathy-centric design, these workshops have also aimed to consolidate the multidisciplinary scholarships and perspectives on empathy and develop a future research agenda on the *a)* upscaling the application

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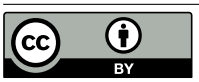

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of Empathy-Centric Design, *b)* rethinking the role of researchers' empathy and evoking it in multi-stakeholder contexts, *c)* ethics of Empathy-Centric Design, *d)* coalescing the varied means and instruments for capturing empathy, and *e)* examining the temporality and materiality of empathy in the design process.

Despite the recognized importance of empathy in HCI/CSCW, the concept remains vague and subject to different interpretations, lacking a consensus on its definition and application [34]. For example, a notable proportion of recent research in HCI/CSCW [42, 105, 138, 163, 167, 176] uses empathy synonymously with emotion, while others [16, 74, 101, 116, 157, 158, 160, 173] consider empathy to be a complex construct that consolidates various factors that extend beyond emotions, including personal traits, socio-technical context, presence (or rather absence) of triggers, etc. Moreover, numerous research works have considered the expression or manifestation of empathy in cognitive, affective, and sympathetic modalities [75, 92, 106, 140, 157]. Still, there is no consensus among HCI/CSCW and design researchers about what empathy is and how it can be meaningfully captured; its temporality and directionality; its impact on the design process, outcomes, and varied stakeholders and communities; and the ethics of empathy-centric design.

To this end, this paper presents a scoping review aimed at addressing this gap by exploring the multifaceted dimensions of empathy within the HCI/CSCW domain.

With this scoping review, we have several key objectives and contributions to the field of HCI/CSCW in mind. *First*, we seek to synthesize different perspectives on empathy to create a cohesive understanding that integrates different viewpoints and approaches. *Second*, our review seeks to identify the gaps and challenges that currently impede a holistic integration of empathy into HCI/CSCW. By systematically mapping the existing landscape of *empathy-centric* HCI/CSCW research, we intend to provide researchers and practitioners with a solid foundation on which to build and extend their work, and to reframe the agenda for future research on empathy-centric design.

Guided by these objectives, our study addresses the following research questions:

- **RQ1:** What are the various interpretations and definitions of empathy within HCI/CSCW, and how do these differing perspectives influence the design and evaluation of empathetic technologies and systems?
- **RQ2:** What are the prevailing methodologies, findings, and trends in studies focusing on empathy within HCI/CSCW?
- **RQ3:** What roles does empathy play in HCI/CSCW in various contexts?

Our findings reveal that empathy in HCI/CSCW lacks a universally accepted definition, incorporating perspectives that focus on cognitive understanding, emotional resonance, or affective response. Empathy takes on multiple components, including dispositional and situational forms, as well as cognitive, affective and compassionate dimensions. Furthermore, we identify five specific roles that empathy plays in studies, ranging from facilitating social connections among users to guiding user-centric designs and improving user-agent interactions. Various methodologies have been employed to measure empathy, from self-assessment tools to biometric data readings. In addition, experiential methodologies and situational awareness are recognized as effective mechanisms for inducing empathy within the HCI/CSCW context.

The broader implications of our work highlight the transformative potential of empathy in enhancing interactions through technology. From our findings, we discuss *a)* the balance between individual and collective emphases in empathy research, *b)* the limitations of a *one-size-fits-all* approach to empathy, *c)* the differences between empathic intentions and real-world outcomes, and *d)* the complex dynamics of emotional mimicry in various social settings. Additionally, our

exploration considers age, gender, and cultural differences, providing an overview of empathy in HCI/CSCW.

By exploring the subtleties of the application, implications, and challenges of empathy within HCI/CSCW, this scoping review aims to facilitate a deeper understanding of how technology can be designed to accommodate and enhance human experiences, emotions, and perspectives, ultimately leading to more meaningful and enriching user experiences.

2 Related Work

The ongoing discourse on empathy within the HCI/CSCW field is closely linked to seminal works, insights and concepts from a wide variety of fields. As the HCI/CSCW community explores the implications and applications of empathy, it is essential to examine existing knowledge and delineate related work on empathy, particularly as it has been understood in other domains and how it has been adapted to fit within HCI/CSCW. In the remainder of this section, we provide an understanding of empathy from other fields and differentiate between relevant but distinct concepts (i.e., Affective Computing).

2.1 Understanding Empathy

Empathy, a term rooted in ancient Greek philosophy, has undergone several transformations in its interpretation and application over the centuries. Originally derived from the Greek *empatheia*, it refers to the act of immersing oneself *in* (em-) the *feelings* (pathos) of another. This innate human ability to internalize and resonate with the experiences of others was first philosophically recognized by Herder [58] who equated it with our connection to nature and, in essence, to our own self. By the end of the nineteenth century, empathy took on a sensory dimension, symbolized by the German term "Einfühlung", which refers to shared experiences with both humans and inanimate objects [50, 121]. More recently, we have witnessed an evolution in our understanding of empathy, transitioning from a purely emotional affiliation to one that requires a degree of conscious detachment, especially in therapeutic contexts where professionals have sought to comprehend the other's emotional and physical state without being overwhelmed [88, 121].

This concept has been subjected to a comprehensive examination in various fields, including psychology, neuroscience, sociology, and other disciplines. In psychology, empathy is traditionally viewed as a multi-dimensional construct [49], encapsulating both *cognitive* (understanding another's perspective) [83] and *affective* (emotionally resonating with another) components [62]. Neuroscience, on the other hand, provides valuable insights into neural pathways underlying empathic responses [2, 33, 71], highlighting the role of the specific brain regions in empathy inference and elicitation.

Furthermore, insights from disciplines such as educational psychology have highlighted the possible correlations between empathy and factors such as retention of learning, self-efficacy, and motivation [77, 93, 125]. For example, studies have revealed that instructors who exhibit higher empathic tendencies often facilitate better engagement and learning performance of students [77, 109]. Similarly, enhanced levels of empathy have been linked to improved quality of life and well-being in a variety of contexts [23, 124].

However, as we tread this multi-disciplinary path, we encounter significant gaps. For instance, while there is a wealth of literature detailing empathy's constructs, a consensus on its metrics and measures remains elusive [28, 43, 89]. In addition to the measures, the duration of empathy interventions underscores several concerns. One criticism is that short interventions may not allow enough time for participants to fully internalize and integrate empathic behaviors into their practice. Wormald and Melia [168] have argued that attempting to cover multiple components of empathy in a short period of time can lead to superficial understanding and limited impact on

empathy levels. Similarly, Smith et al. [142] observed in their systematic review that although both long and short interventions produced high effect sizes in promoting sustained changes in empathy, the longer interventions were more effective in these changes.

As both HCI/CSCW and design study and use empathy, it is essential to acknowledge these gaps and challenges. The important implications of empathy in other domains emphasize its essential role in enhancing and reshaping user experiences. By embracing a broad understanding from a variety of fields, HCI/CSCW researchers and practitioners will be able to more effectively incorporate empathy into design and interaction, facilitating meaningful human-centric approaches and enriching experiences.

2.2 Affective and Empathic Computing

Exploring the relationship between emotion, empathy and computing leads to the concepts of Affective Computing and Empathic Computing. Affective Computing emphasizes the development and deployment of systems and devices that can recognize, interpret, and respond to human emotions [123]. It seeks to give technology an emotional quotient and to promote more intuitive and emotional human-computer interactions.

Empathetic Computing, on the other hand, hinges on the premise of not merely recognizing or simulating emotions but truly understanding and resonating with the user [14, 17]. The key principle here is to create interfaces and technologies that don't just appeal to their users on the surface, but resonate with them on a deep level, creating a deep sense of connection and understanding. These two paradigms, albeit distinct, converge on a common goal: to enhance the adaptability of socio-technical systems, making them more user-centered, relatable, intuitive, and effective.

While Affective Computing primarily focuses on understanding and responding to human emotions, empathetic computing takes it a step further by aiming to understand, induce, and exhibit empathy in machines [99]. We argue that the fine line between Affective and Empathetic Computing often gets blurred, leading to confounded research outcomes. Moreover, there is a pressing need to distinguish between genuine empathy elicitation and mere emotion simulation, especially in the design of interfaces and technologies.

In exploring the complex field of empathy in HCI/CSCW, our focus rests heavily on Empathy-Centric Design [43, 103, 158] – an emerging notion in HCI/CSCW that aims to critically rethink and reposition the role of empathy in designing technologies for different user groups with varying needs, experiences, and expectations. Empathy-centric design distinguishes itself from similar notions such as Affective Computing, by considering the holistic embodiment of empathy as a key research and design quality, rather than its emulation through computational means. Consequently, in our scoping review, we specifically consider research that has studied empathy and its relationship to people and societies, and that has also employed empathy as a central premise for designing for diverse user groups. At the same time, we limit our search within the extensive literature on computational approaches to emulating affective responses in technologies, such as Affective Computing.

3 Scoping Review

In this section, we outline our method for conducting the scoping review. We detail our search strategy and data sources, the process for removing duplicates and screening for eligibility, the criteria for including and excluding papers, and finally, our approach to data extraction and analysis. We reported our analysis using the Preferred Reporting Items for Systematic review and Meta-Analysis extension for Scoping Reviews (PRISMA-ScR) checklist [155].

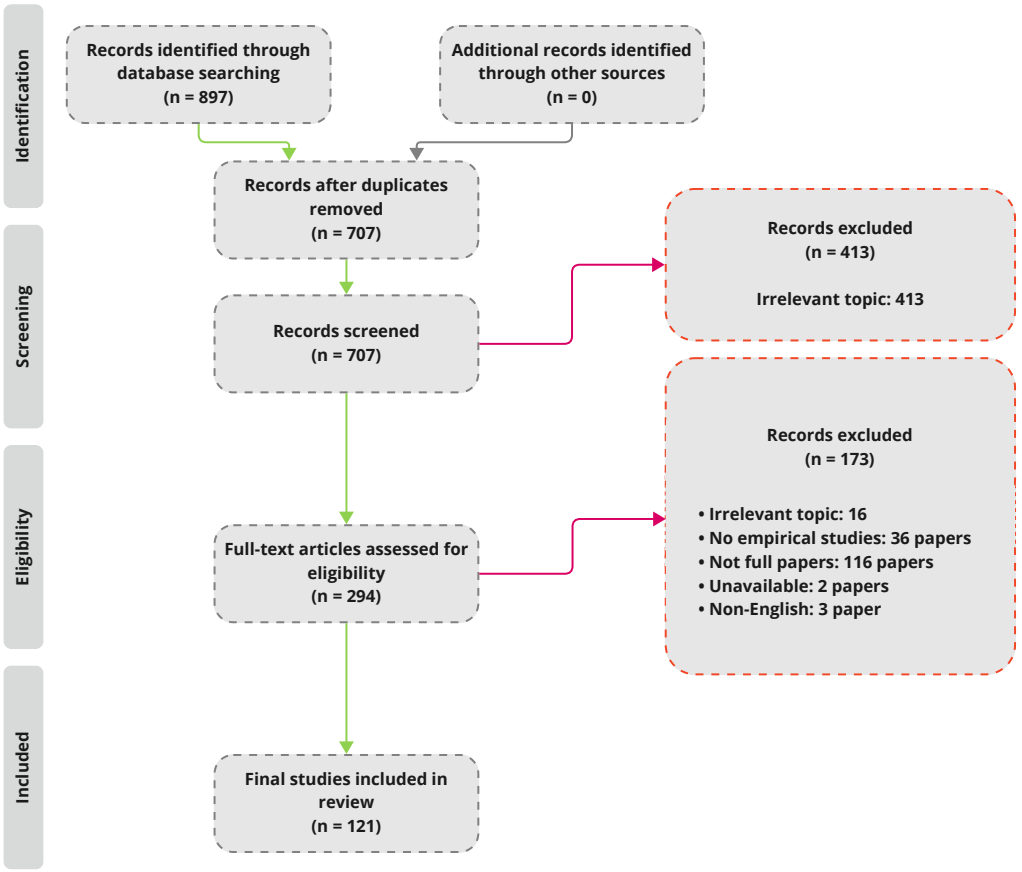

Fig. 1. PRISMA flowchart of study selection process.

3.1 Search Strategy and Data Sources

As defined by Daudt et al. [36], "scoping studies aim to map the literature on a particular topic or research area and provide an opportunity to identify key concepts; gaps in the research; and types and sources of evidence to inform practice, policymaking, and research." In line with this objective, our study aimed to identify how the concept of empathy is approached in HCI/CSCW, how empathy is defined, operationalized, and implemented in HCI/CSCW research, and prevalent methodologies, findings, and trends (Figure 1).

To address our research questions and aim, we initiated a concentrated search on the ACM Digital Library[1]. We chose the ACM Digital Library because it is a comprehensive source for HCI/CSCW publications, providing a focused dataset exclusively on the field of computing for this scoping review. While this choice may have omitted relevant studies published outside this database, our review should be seen as an initial exploration, and further studies could expand the scope to include these and other sources to build a more exhaustive body of research on empathy in HCI/CSCW.

[1]ACM Digital Library: https://dl.acm.org/

We used the search query with the keyword "Empath*" in the abstract section to ensure a inclusion of papers that directly address empathy in HCI/CSCW. We made this choice to keep the search specific to *empathy* and to avoid the ambiguity that terms like *sympathy* or broader concepts like *affective computing* might introduce. While broader or related terms are pertinent, they might deviate from our core focus of examining *empathy* in its most direct context within HCI/CSCW. As of April 2023, this search yielded an initial corpus of 897 papers.

3.2 Duplicate Removal and Eligibility Screening

We used DistillerSR[2] to identify and remove duplicate papers, which led to the exclusion of 190 papers. Then, two authors independently screened the abstracts of the remaining 707 papers, achieving a high agreement rate ($\kappa = .81$, as measured by Cohen's Kappa for inter-rater reliability). We resolved any disagreements about specific papers through discussions. This screening process resulted in the exclusion of 413 papers. The primary inclusion criterion was the explicit mention or application of empathy in HCI/CSCW. We included studies that utilized, observed, or operationalized empathy within HCI/CSCW. We excluded papers that did not explicitly address empathy in HCI/CSCW or only mentioned empathy tangentially without substantial focus or application. Ultimately, we selected 294 papers for full-text reading (Figure 1).

Table 1. Code categories from the analysis of literature.

Code Category	Description
Contexts	Overview of key areas and environments where empathy is studied.
Definitions of Empathy	The diverse interpretations and explanations of empathy provided in the literature.
Empathy Constructs	Empathy is a multifaceted construct that manifests itself in different ways and forms. This code category encapsulates these different components, along with the existing conceptualization of its experiential qualities.
The ways of inducing Empathy	Methods and techniques employed to evoke or enhance empathetic feelings in individuals.
The ways of inferring Empathy	Approaches to understanding and deducing whether someone is experiencing empathy based on their behavior or responses.
Empathy in Various Groups	Manifestations and perceptions of empathy across different demographics, cultures, or communities.
Implications in HCI/CSCW & Design	The role played by empathy in HCI/CSCW and design practices.
Perspectives for Empathy	Different viewpoints or philosophies regarding the concept and importance of empathy.

[2]DistillerSR: https://www.distillersr.com/products/distillersr-systematic-review-software (last visited on 16/01/2024).

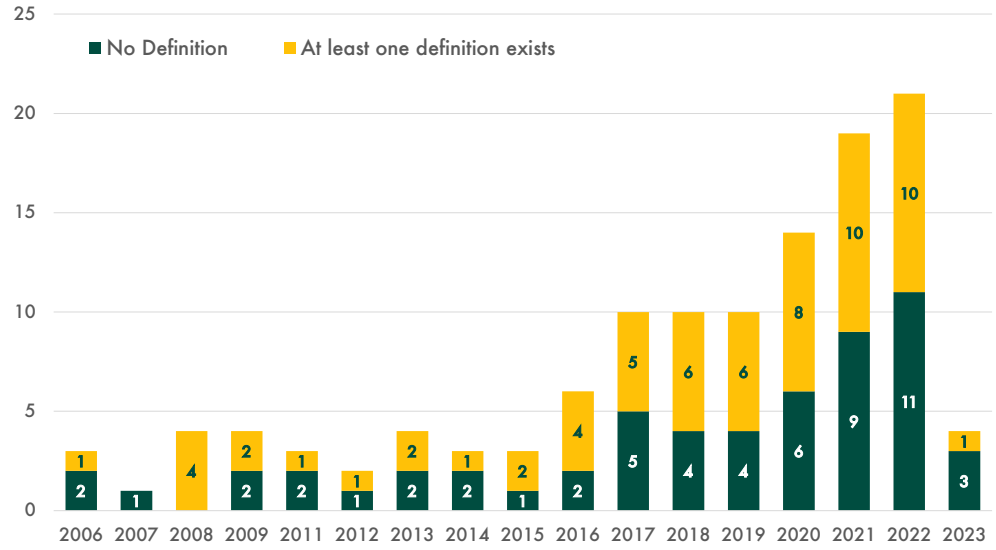

Fig. 2. The distribution of publications by year and whether they explicitly state the definition of empathy or not.

3.3 Inclusion and Exclusion Criteria

In the full-text review process, we applied several exclusion criteria to maintain the relevance and quality of the papers for this scoping review. First, we excluded 116 papers because they were not full papers, such as short papers and posters, and potentially lacked the depth and comprehensiveness essential for our study. We discarded another 36 papers due to the absence of empirical studies or interventions. We also excluded 16 papers that did not directly pertain to the topic of Empathy in HCI/CSCW. Additionally, we found 2 papers inaccessible and excluded 3 for being non-English. After adhering to these criteria, we selected 121 papers for the final review (see Figure 1).

3.4 Data Extraction and Analysis

We conducted our analysis using ATLAS.ti[3], a qualitative data analysis software that enhances the efficiency of sorting, structuring, and categorizing large data sets. We applied Reflexive Thematic Analysis (RTA) [20–22] to explore the experiences and opinions presented in the papers. Initially, the first author analyzed ten papers and then discussed the codes with the second author for refinement. We repeated this iterative process several times to ensure the coding process was aligned and rigorous. Overall, we grouped the quotes into eight main categories (e.g., 'Inferring Empathy') and created 186 subcodes (e.g., 'Qualitative Empathy Exploration'). We then organized these codes into seven themes, which we will discuss in the following sections.

4 Results

In the following sections, we provide a general overview of the reviewed papers, the dimensions, aspects and typologies of empathy in HCI/CSCW, offering an understanding of how empathy manifests in the domain and examining the different roles it plays. We also explore the various methods used to measure empathy, including self-report, observer-report, quantitative, biometric,

[3]ATLAS.ti: https://atlasti.com (last visited on 16/01/2024).

sensory metrics, and qualitative exploration, each of which provides unique insights into the complex nature of this phenomenon. Finally, we identify the mechanisms that induce empathy in HCI/CSCW, the processes and contexts that facilitate the development of empathetic human-technology interactions.

4.1 General Focus of the Studies

Table 2. General categories for focus of the papers.

Study Focus	Papers
Healthcare and Therapy	[8, 29, 39, 74, 96, 110, 114, 116, 120, 129, 166, 173]
Children and Education	[1, 3, 11, 41, 55, 68, 72, 92, 102, 105, 106, 131, 147, 150, 153, 160, 162, 163, 171, 177]
Design and Development	[7, 51, 75, 86, 91, 95, 101, 111, 118, 136, 137, 139, 158, 159],
Social Interaction and Communication	[4, 11, 26, 27, 42, 48, 61, 66, 73, 79, 87, 115, 128, 141, 152, 157, 170]
Accessibility and Inclusion	[12, 19, 53, 80–82, 84, 90, 94, 97, 113, 143, 165, 174]
Virtual and Conversational Agents	[5, 25, 52, 63, 64, 104, 112, 117, 126, 134, 138, 149, 162, 164]
Human-Robot Interaction	[6, 16, 31, 140, 144, 151, 172]
Digital and Virtual Environments	[15, 70]
Transportation	[13, 98, 130, 161, 176]
Empathic Technology Development	[32, 35, 54, 57, 67, 85, 135, 167]
Miscellaneous	[18, 24, 30, 76, 78, 122, 145, 154, 156, 175]

In our scoping review, 121 papers across eleven categories (see Table 2) highlight the diverse roles of empathy in technology interactions. It's important to note that some papers may fall into more than one category, and that these categories may overlap. In addition, certain foundational themes, such as social interaction and computer-mediated communication, may emerge as key contributions or underlying methodologies in specific application areas.

In healthcare and therapy, empathic technologies such as virtual counselors and healthcare robots (e.g., [74, 96]) have aimed to improve patient care and adherence to treatment regimens. Similarly, in educational contexts that involve children, technologies such as persuasive sociometric tools and empathetic social robots (e.g., [92, 102]) have been instrumental in promoting empathy in children, which has had a significant impact on educational outcomes.

Studies have examined how empathy affects technology-based social interactions, such as the development of empathetic robots and conversational agents, enhancing user satisfaction (e.g., [27, 42, 61, 87]). They also explore gamification and sensor technologies in children's environments, facilitating prosocial behavior and collaboration (e.g., [11, 26]). Additionally, research on online networks, virtual teams, and biosignal synchronization offers insights for empathy training (e.g., [79, 141, 157]). Other studies examine empathy in different contexts, including cultural aspects (e.g., [115, 128, 170]). This category of social interaction and communication is thus highly central to the domains of CSCW and HCI.

In the design and development context, existing research highlights the empathy gap in the design of software and technological artifacts and the importance of understanding user perspectives, especially in critical application areas (e.g., [101, 118]). Moreover, the exploration of empathetic virtual and conversational agents (e.g., [104, 162]), and their applications in education, healthcare, and customer service, showcases the growing sophistication of affective computing.

In the area of accessibility and inclusion, research has focused on empathy and understanding for people with various disabilities and impairments. A notable theme is the development and evaluation of innovative systems and models, such as the Aphasia Emulation Software (ACES) and Virtual Reality (VR) based simulations, aimed at facilitating empathic understanding for conditions such as aphasia and autism, as well as sensory impairments ([53, 80, 165, 174]). These technologies provide neurotypical individuals with immersive experiences simulating the challenges faced by those with disabilities, thereby fostering patience, awareness and a deeper comprehension of these conditions.

The studies in the field of Human-Robot Interaction (HRI) have revealed the nuances of empathy in interactions with both physical and simulated robots. They have also highlighted the importance of congruence in empathetic responses to the users' states (e.g., [140, 144]). In digital and virtual environments, research such as [70] and [15] emphasizes the role of immersion and biofeedback in augmenting empathy. Transportation-focused studies (e.g., [13, 130]) showcase empathic human-computer interfaces improving driving safety and performance. Empathic Technology Development, with advancements like auditory empathic interventions and social drones (e.g., [57, 167]), explores novel ways to foster social empathy and understanding. Lastly, the *Miscellaneous* category covers a broad spectrum, from environmental awareness to the dynamics of gig work, revealing the pervasive nature of empathy in HCI (e.g., [24, 175]).

4.2 Definitions and Interpretations of Empathy

In HCI/CSCW, empathy emerges as a nuanced and multifaceted concept, mirroring its complex representation in the broader psychological literature. The significance of empathy within HCI/CSCW is undisputed, yet the field lacks a clear, universally accepted definition as also highlighted by many papers [3, 6, 18, 25, 70, 85, 96, 111, 119, 160, 170]. Such an absence poses challenges for the effective operationalization, evaluation, and implementation of empathy in HCI/CSCW contexts.

Highlighting the complexity of the term, a remarkable 43 different definitions of empathy exist in psychology literature [34]. This plurality of perspectives has found its way into HCI/CSCW and design, creating a void of homogeneous conceptualization (see Table 3). This void not only hinders the development of cohesive approaches to harnessing empathy in human-technology or technology-mediated interactions, but also challenges its practical application.

Our exploration uncovers a telling dichotomy: while 64 papers take the initiative to define empathy explicitly, an almost equal count of 57 papers refrain from offering a concrete definition. This points to a shared recognition of empathy's centrality in HCI/CSCW, juxtaposed against the field's ongoing challenge of establishing a standardized comprehension. Such a scenario further amplifies the challenges associated with the operationalization, assessment, and interpretation of empathy.

4.2.1 An Ability to Understand and Interpret Experiences of Others. Empathy predominantly manifests in this category [8, 54, 66, 75, 80, 101, 119, 144, 149, 157, 158, 160, 171, 173] and this interpretation generally leans towards a cognitive dimension, underscoring the comprehension of another's emotional state and perspective. Such an understanding has been deemed essential for designers and developers to adopt each other's points of view [101]. Several papers have extrapolated this further, suggesting that empathy not only helps one discern the feelings and thoughts of others

Table 3. Main definition categories used in the papers.

Definitions & Interpretations of Empathy	Papers
An Ability to Understand and Interpret Experiences of Others	[6, 8, 12, 16, 25, 48, 54, 66, 72, 74, 75, 80, 101, 112, 116, 119, 144, 149, 157, 158, 160, 161, 167, 171, 173]
Putting Oneself in the Other's Perspective	[19, 25, 32, 53, 84, 86, 92, 94, 117, 118, 143, 147, 162, 167, 174, 176]
An Affective Response to Another's Situation	[3, 6, 8, 18, 31, 53, 55, 63, 92, 97, 104–106, 129, 151, 152, 156, 170]
Other Definitions	[6, 52, 64, 90, 104, 106, 111, 112, 131, 154]
No definition provided	[1, 4, 5, 7, 11, 13, 15, 24, 27, 29, 30, 39, 41, 42, 51, 57, 61, 67, 68, 73, 76, 78, 79, 81, 82, 87, 91, 95, 98, 102, 110, 113–115, 120, 122, 126, 128, 130, 134–139, 141, 145, 150, 153, 159, 163–166, 172, 175, 177]

[157], but also identify and resonate with their emotions, motivations, values, and even inner conflicts [75]. Additionally, this empathic ability is pivotal for individuals to penetrate into the subjective world of others, thus facilitating a deeper connection and understanding [171]. The consistent emphasis on understanding and interpreting experiences underscores empathy's integral role in driving design processes and nurturing productive collaboration in the field of HCI/CSCW.

4.2.2 Putting Oneself in the Other's Perspective. Empathy is commonly conceptualized as the act of stepping into someone else's shoes [19, 25, 117, 174]. This perspective-taking emphasizes both understanding and, in some instances, immersing oneself in the affective state of another [32]. For instance, in the domain of Human-Robot Interaction (HRI), the robot's affective behavior mirrors the user's performance, reinforcing the user-oriented nature of empathetic interaction [92]. In other contexts, systems have been designed to emulate specific conditions, such as aphasia, to promote deeper understanding and enable individuals to metaphorically walk in another's shoes [53]. Roger's [133] definition (as quoted by [162]) supports this view by highlighting empathy as a process where one places oneself in another's situation, striving to perceive their feelings and thoughts. This view is not restricted to person-to-person interactions; it extends to human-computer communications where empathy enables individuals to place themselves into the position and feelings of another—virtual—entity [176]. Empathy in these contexts seeks to build altruistic behavior on the part of—conversational and virtual—agents to augment humans or to de-escalate tensions in certain situations [25].

4.2.3 An Affective Response to Another's Situation. As the third category, Empathy in HCI/CSCW and design often focuses on the affective dimension, viewing it as an emotional process fundamental

to human interactions. Central to this perspective is the notion of empathy as an "*affective response more appropriate to someone else's situation than to one's own*" [92]. This definition is echoed in various studies, which emphasize that empathy facilitates the creation and development of social relationships, enhancing fondness and affiliation [92]. Notably, empathy is positioned as a cornerstone of interpersonal communication, where it serves as an emotional gateway to the experiences and emotions of others, allowing one to predict and understand their feelings and thoughts [53]. Taking a socio-psychological angle, some scholars argue that empathy enables an individual to vicariously respond to another's situation, emphasizing its function as a psychological process that aligns a person's feelings more with another's circumstances than their own [3, 8, 106, 129]. At its essence, empathy is conceptualized as the expression of emotion contingent on another's predicament and not solely one's personal experiences [105]. This affective response of empathy builds a richer and smoother human-human and human-agent interactions, serving as the basis for effective communication and understanding in both HCI/CSCW and broader design contexts [63].

4.2.4 Other Definitions. As described above, while there are a few dominant definitions of empathy in the HCI/CSCW and design literature, there is still a spectrum of diverse perspectives. For instance, some research situates empathy as a "*complex socio-psychological construct*" that intertwines cognitive awareness of another's internal states with emotional alignment with their situation [104, 106]. From a more process-driven angle, empathy is considered a mental sequence in interpersonal contexts influencing how one interacts with others [112]. Davis [38] (also quoted in [6]) offers a definition that connects the empathetic responses of an individual to the experiences of another, emphasizing its relational dimension. Mencl et al. [107] (also quoted in [154]) describe empathy as a "*positive moral emotion*" that aids in reasoning.

The challenge of defining empathy is highlighted by the fact that there is not a universally agreed-upon definition, with some authors referring to it as the act of experiencing perceived emotions of others [111]. Ickes [65] (referenced by [52]) describes empathy as a complex psychological inference drawing from observation, memory, knowledge, and reasoning to understand others' subjective experiences. Furthermore, Wright and McCarthy [169] (referenced in [90]) elaborate on the evolutionary nature of empathy in relationships, noting the iterative process of fine-tuning empathetic responses based on prior interactions.

4.3 Constructs of Empathy

Empathy can be broken down into distinct constructs—such as dispositional and situational empathy, as well as its cognitive, affective, and compassionate dimensions—that contribute to its understanding and expression. These constructs are more prominent, and in contrast to the heterogeneity in the definitions of empathy, there is more consensus in the definitions of these constructs.

Beyond these core constructs of empathy, the existing literature also examines additional layers—such as emotional contagion, perspective taking, emotional reactivity—that contribute to the understanding of empathic experiences. These layers, in turn, offer insights into how users' emotional and cognitive processes intertwine with technological systems, impacting the user experience and shaping design considerations. In this section, we explore these components, highlighting their importance and how they have been explored in existing research.

4.3.1 Dispositional and Situational Empathy. Empathy within HCI/CSCW literature has been dissected into two overarching categories. Dispositional empathy, as outlined by [149], is a reflection of a person's innate tendency to understand and adaptively respond to the emotions of others, which is consistent with the understanding of a person's general tendency or ability to empathize [140]. This intrinsic tendency to empathize can play a crucial role in determining how people engage

with others, which in turn influences interpersonal distances in social interactions [149]. Such a tendency has also been instrumental in psychological profiling [44, 69], because of its pervasive nature in shaping one's general empathic disposition.

Situational empathy, on the other hand, emerges as a response to particular contexts or stimuli. It focuses on an individual's empathic response within specific situations [140]. As noted by Joby and Umemuro [73], *situational empathy* and its associated sub-dimensions—*cognitive* and *affective* empathy—underscore the empathic responses elicited by agent stimuli. This dimension of empathy, as a result, can offer insights into the varied impacts that stimuli, such as distressing events or encounters with technology, might elicit at a specific juncture. Interestingly, the empathic tendencies highlighted by Morita and Kano [112] suggest that situational empathy can catalyze the adoption of perspectives that lead to empathy-based actions, such as helping behavior.

When considering the spectrum of dispositional and situational empathy, it's important to note that these dimensions might not always resonate. As Seo et al. [140] argue, there is a potential divergence; someone with subdued dispositional empathy may still exhibit strong situational empathy under certain circumstances, and vice versa. This dichotomy holds additional significance in HCI/CSCW. Given the variety of interactive situations, situational empathy becomes critical to designing user experiences that are deeply aligned with the user's current state during specific interactions.

4.3.2 Cognitive, Affective and Compassionate Empathy. In addition to the situational and dispositional components, empathy in HCI/CSCW research has been investigated and operationalized with three additional constructs: *cognitive*, *affective* and *compassionate* empathy. Cognitive empathy, at its core, focuses on the ability to understand and recognize the feelings, situations, and experiences of others [3, 18, 35, 96, 119, 131, 161]. This component described as "*knowing what another person is knowing*" [161], emphasizes the importance of perspective taking, enabling individuals to understand specific situations such as another's discomfort in a social setting [157] or the challenges faced after losing a job [140]. In this capacity, cognitive empathy serves as a pivotal tool in promoting improved communication, reducing biases, and promoting better negotiation outcomes [75].

Conversely, affective empathy focuses on the emotional aspect, evoking immediate, often reflexive, emotional responses to other's feelings [18, 96, 131, 161]. Such reactions can range from feeling sadness upon witnessing an accident [140] to unconsciously mirroring someone's distress or joy [18]. This component of empathy involves emotional contagion, behavioral mimicry, and synchronization processes, potentially leading to a genuine resonance with other's emotional state [6, 92, 157, 167].

In practical HCI/CSCW contexts, the relationship and distinction between cognitive and affective empathy play significant roles. For example, the games designed to raise awareness of the living conditions of HIV/AIDS patients promote cognitive empathy through the interactivity of the games; affective empathy was triggered by the design aesthetics and the overall interaction experience [177]. Moreover, studies in virtual reality demonstrated that while users could cognitively grasp the lived experiences of the visually impaired, the brief exposure limited the depth of their affective empathy [174]. Such interactions and dependencies between the two dimensions extend beyond games and virtual reality, are being studied in HCI/CSCW fields like human-robot interactions (HRI) and narrative-driven platforms [92, 170].

The synergy between cognitive and affective empathy is critical for HCI/CSCW researchers and practitioners. While cognitive empathy provides an analytical understanding of the user's states, affective empathy facilitates authentic emotional connections. By bringing these dimensions together, designers can innovate interfaces that not only meet functional needs, but also resonate

emotionally with users, cultivating technologies that users perceive as more than just tools – they become relatable companions [158].

In addition to these frequently mentioned constructs, the understanding of compassionate empathy proves vital, representing an essential layer that goes beyond mere emotional resonance or comprehension. Compassionate empathy includes not only the distinction of individual emotional experiences but also a genuine motivation to stimulate actions that support the well-being of others. Such a component suggests that simply recognizing or mirroring emotions is insufficient; instead, it highlights a deeper inclination to alleviate suffering and to take proactive steps in this direction.

Morita and Kano [112] elaborate on this aspect by emphasizing that an empathic tendency can lead to the adoption of another's perspective, which subsequently induces empathic helping behavior. Similarly, Choi et al. [29] echo Ekman's (see [46]) conceptualization of compassionate empathy, in which emotional resonance culminates in a "*reactive resonance*" – a cognitive and behavioral process that instigates an enduring desire to care. It further emphasizes the transition from pure emotional empathy to tangible expressions of compassion and care, as facilitated through features like empathy buttons and hashtag-driven chatrooms. This proactive, behavioral part of empathy is consistent with what Jumisko-Pyykkö et al. [75] and Otterbacher et al. [119] emphasize in noting the importance of compassionate empathy. Compassionate empathy is underlined as a motivational component, central to promoting actions such as helping, cooperation, and enhancing interpersonal dynamics. This triadic understanding, which includes *a)* cognitively grasping feelings, *b)* emotionally resonating, and *c)* compassionately responding, provides a comprehensive picture of empathy in its entirety, hinting at the layered and actionable potential it holds within the domain of HCI/CSCW and design.

4.3.3 Emotional Contagion, Reactivity and Mimicry. Various studies have underscored the role of emotional contagion in inducing empathy between users and technology. This covers the system's ability to discern and reflect the user's emotional state, as seen when an intelligent system recognizes it through speech intonation and subsequently reflects it through facial expressions, leading to perceived appropriateness and timely responses [92]. The phenomena of emotional contagion and mimicry aren't just limited to automated systems; they're modulated by various social factors like group membership, dominance, initial affiliative bond, and empathy among others [73]. For instance, even a still image of a virtual character expressing joy can incite emotional contagion in humans [73]. Furthermore, emotional contagion is positively linked with several social attributes such as trust, empathy, and affiliative intent, thus acting as a potential surrogate for these measurements [73]. Emphasizing its role, Hatfield et al. [56] (referenced in [176]) outlined emotional contagion as the automatic tendency to mimic and synchronize with another's expressions, postures, and movements, resulting in emotional convergence. Thus, emotional contagion, facilitated by mimicry, enhances emotional resonance, presenting opportunities for fostering stronger connections between users and technology, especially in emotionally charged contexts.

The concept of emotional reactivity emerges as a crucial aspect in HCI/CSCW [141]. Emotional reactivity signifies the synchronization of emotional states between users and technology, indicative of mutual emotional engagement between the pair [141]. This phenomenon, closely aligned with affective empathy, includes an individual's ability to resonate with and experience others' emotions [157]. Emotional mimicry and contagion, fundamental features of reactivity, are influenced by various social factors, including group membership, dominance, affiliative bonds and levels of empathy, among others [73]. Hess and Fischer's social context theory [59, 60] (referred in [73]) accentuates the selectivity in emotional mimicry, prioritizing emotions that enhance affiliative goals. At the same time, emotional reactivity serves as a bridge between users and technology, is

influenced by myriad factors, and plays a critical role in driving mutual emotional engagement, empathy, and trust.

4.3.4 Perspective Taking. Perspective taking is the conscious effort to recognize and comprehend others' emotional and psychological states, covering both *perceptual* and *conceptual* dimensions. While perceptual perspective taking allows individuals to understand how others experience different situations through different senses, conceptual perspective taking is geared toward understanding the emotional viewpoint of others, including goals, intentions, and motives [6]. This process is a recognized aspect of empathy [101] (see [148]) and can be modulated by drawing attention to others' emotions and affective states [79]. In gaming contexts, as an illustration, integrating feedback from players' perceptions can refine interaction experiences among them, as understanding emerges from combining different pieces of information [26]. Moreover, *narrative empathy*, the emotional and cognitive response induced by engagement with narratives, underscores the role of perspective taking; such engagement can evoke empathy even by merely imagining the plight of others or generalizing it to a broader group or situation [18, 144]. In contrast, the absence of shared experiences can hinder perspective taking, as evidenced by some studies showing difficulty empathizing with narrative characters when there is a lack of available relatable experiences [76]. The breadth of literature, however, suggests context-specific research with limited generalizations, emphasizing the need for comprehensive models integrating emotional contagion, self-awareness, and perspective taking to authentically replicate empathy [6].

4.3.5 Empathic Accuracy. Empathy accuracy (EA) refers to the degree of success in interpreting another's thoughts and feelings, also described as "*daily mind reading*" [35, 72]. This capability incorporates both cognitive and affective components of empathy, emphasizing the importance of recognizing and responding appropriately to the emotions of others [70, 75]. Research in HRI and HCI/CSCW reveals that the proper introduction of empathic behaviors, such as appropriate backchannels, significantly influences user perceptions, with missteps potentially leading to user confusion [87, 92]. In addition, empirical evidence suggests that the accurate expression of empathy can lead to positive outcomes such as increased trust, well-being, and social inclusion, while its inappropriate expression can lead to undesirable outcomes [116]. Thus, future technological agents need to accurately detect user emotions and produce adequate responses, especially considering that individuals often mirror each other's emotional states during communication [149].

These facets—mirroring emotions, mutual engagement, understanding perspectives, accurately gauging emotions, or reactively addressing emotional states—each play a different role in shaping the HCI/CSCW landscape. Future innovations in technology and design can undeniably benefit from a holistic appreciation of these dimensions of empathy. Integrating these facets facilitates not only effective human-technology interaction, but also the development of more empathic and responsive digital landscapes, thereby creating a symbiotic relationship between users and their technological counterparts.

4.4 Directionality of Empathy

Based on our review, we identified five types of directionalities that empathy employs in HCI/CSCW. These directions range from fostering empathy between users to integrating empathy into artificial agents (Figure 3). Below, we elaborate on each type:

4.4.1 Users Empathizing with Users. This is the most prevalent type identified in the literature, focusing on interventions that aim to develop empathy among users for understanding each other's circumstances. These studies often involve social platforms, collaborative technologies, or virtual environments that allow users to step into each other's shoes, so to speak. The primary

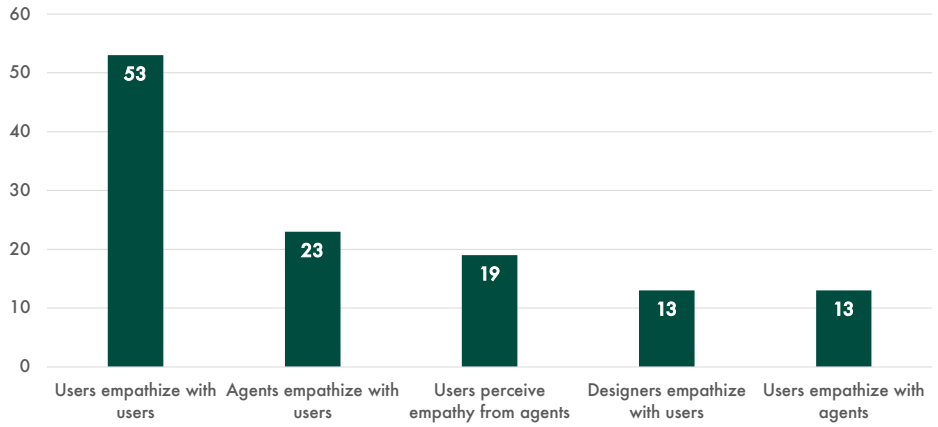

Fig. 3. Distribution of papers across the *five* different directionalities of empathy in HCI/CSCW.

aim is often to facilitate social connection, emotional understanding, and collaborative work. [4, 15, 18, 19, 24, 26, 29, 30, 32, 35, 48, 51, 53, 54, 67, 70, 72, 78–82, 84, 85, 91, 94, 97, 101, 102, 111, 115, 120, 122, 128, 136, 144, 145, 147, 151, 152, 154, 157, 161, 165–167, 170, 171, 173–175, 177]

4.4.2 Designers Empathizing with Users. Although scarce, research focusing on how designers can develop empathy for their end users is critical to creating user-centered designs. Typically, these studies employ methodologies like ethnographic studies or user interviews to help designers develop a deeper understanding of user needs, desires, and limitations. This in turn informs the design process to yield more accessible and effective products. [7, 12, 75, 86, 90, 95, 113, 118, 139, 143, 150, 158, 159]

4.4.3 Users Empathizing with Agents. In this type, interventions aim to instill empathy in users toward artificial agents, such as robots, chatbots, or virtual assistants. These studies examine how a more empathetic understanding toward agents might affect user interaction, engagement, and satisfaction. Often, this research utilizes emotionally-responsive agents to examine whether users are more inclined to interact genuinely and thoughtfully when they perceive the agents as sentient beings. [5, 11, 31, 41, 57, 68, 73, 74, 76, 112, 134, 137, 140, 153]

4.4.4 Users Perceive Empathy from Agents. A close counterpart to the third type (see Section 4.4.3), this category of research aims to design artificial agents so that users perceive them as empathetic entities. The goal here is not just interaction but emotional support and validation for the user, often measuring outcomes like trust, long-term engagement, and emotional well-being. [1, 6, 8, 16, 42, 55, 61, 63, 87, 92, 106, 116, 126, 131, 138, 156, 162, 164, 172]

4.4.5 Agents Empathizing with Users. Aligned with the fourth type (Section 4.4.4) but distinct in its objectives, these interventions aim to develop artificial agents that can understand a user's situation without necessarily being perceived as empathetic. Essentially, the focus is on the agents' back-end emotional algorithms and how they process and respond to user input. Such systems are foundational to the field of empathetic computing. These studies often measure the effectiveness of empathy models in yielding better user experience metrics, such as task completion rates or user satisfaction scores. [3, 13, 25, 27, 39, 52, 64, 66, 96, 98, 104, 105, 110, 114, 117, 129, 130, 135, 141, 149, 160, 163, 176].

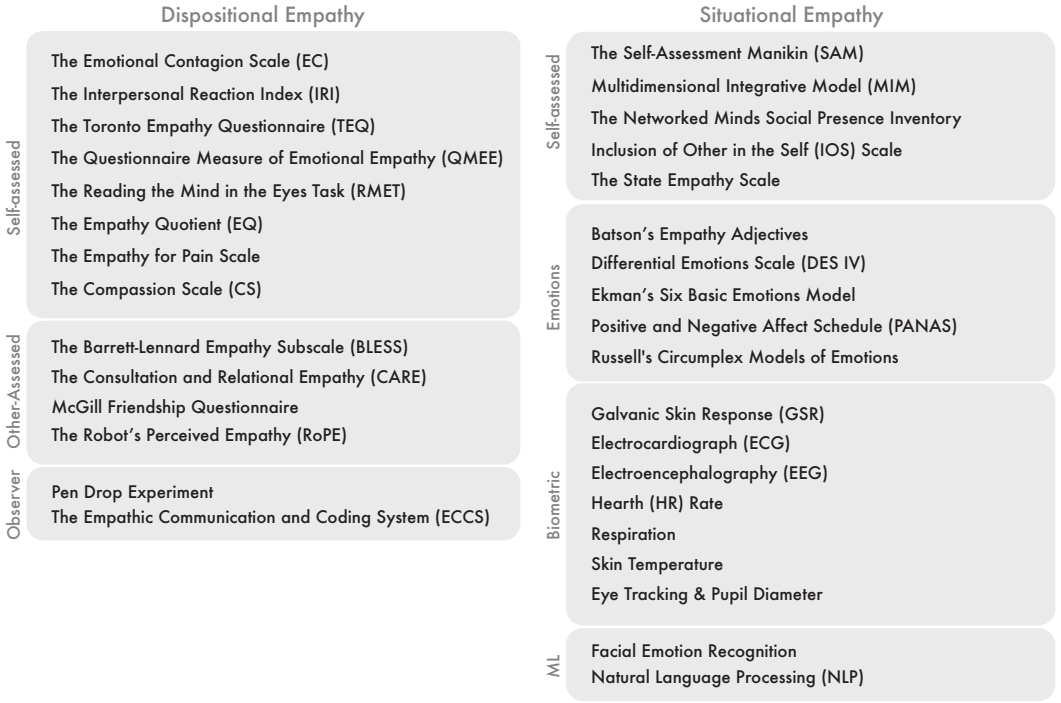

Fig. 4. Overview of instruments used to gauge empathy.

4.5 Measures and Methods for Capturing Empathy

In this section, we present an overview of the various methodologies used to measure and capture empathy in HCI/CSCW (Figure 4). The approaches range from self-assessment and observer-assessment surveys to quantitative, biometric, and sensory metrics, as well as qualitative explorations (Figure 5).

4.5.1 Self- and Observer- Assessment Measures. In our analysis, self-assessment surveys emerge as a prominent and widely used method to understand and quantify empathy in HCI / CSCW. A variety of self-assessment tools have been used, each revealing unique insights into empathy research.

One fundamental tool commonly used in HCI / CSCW studies [66, 76, 104, 106, 112, 119, 126, 144, 167, 170] is the *Interpersonal Reactivity Index* (IRI), which was initially introduced by Davis [37]. This scale consists of four different subscales: *empathic concern*, *perspective taking*, *personal distress*, and *fantasy*. The adoption of IRI reflects a recognition of empathy as a complex construct with various dimensions. Another commonly utilized measure is the *Empathy Quotient* (EQ) [76, 112, 115, 157, 158, 170], developed by Baron-Cohen and Wheelwright [9]. The EQ assesses empathy through both cognitive and emotional components, providing an understanding of empathy as a personality trait (i.e. dispositional empathy).

Beyond these established measures, some researchers opt for more tailored approaches. For instance, the *Consultation and Relational Empathy Measure* (CARE) [108] is used to assess empathetic perception in specific contexts, such as healthcare [8, 74, 120]. Instruments like the *Toronto Empathy Questionnaire* [146] and the *Reading the Mind in the Eyes Task* (RMET) [10] cater to specific

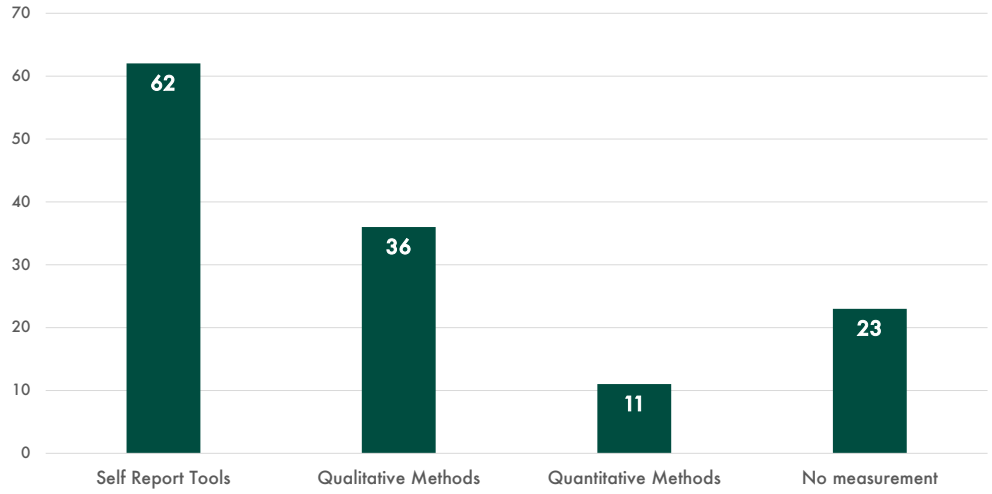

Fig. 5. Distribution of approaches used to evaluate empathy.

research goals, such as assessing empathy propensity and mental and emotional perspective-taking, respectively [27, 149, 160, 161, 167]. These tools highlight the adaptability of self-assessment tools in empathy studies to address needs of various context.

In line with this trend, custom-designed, short, but not empirically validated questionnaires are often used to capture immediate responses from the user's on their empathic states, especially in usability tests or prototyping sessions [92]. These quick and focused tools [29, 30, 35, 51, 61, 63, 117, 137, 144, 147, 149, 162, 164, 167, 176, 177] enable researchers to explore empathy in real-time interactions.

Beyond these self-report measures, observer-assessment measures have also been employed to gain insights into empathy. For example, the *Pen Drop Experiment* used by Nguyen and Canny [115] measures a person's tendency to automatically act in a helping manner toward another person because of the established link between empathy and helping behavior [45]. In addition, the *Empathic Communication and Coding System* (ECCS) evaluates the empathy level of empathic responses [173], and the *Annotation Scheme* is used to evaluate the emotional empathy writing level as well as the cognitive empathy writing level of received texts [160]. These observer-assessment measures offer valuable insights into empathy and helping behavior, complementing the information gathered through self-assessment tools.

However, it's crucial to acknowledge the limitations inherent in both self-assessment and observer-assessment methodologies. Respondents' subjectivity and response bias can potentially affect the accuracy of reported feelings in self-assessment measures [132]. Similarly, observer-assessment measures may also be influenced by the observer's own biases and perceptions. Social desirability and lack of self-awareness may influence users' self-reports, raising concerns about the reliability of the collected data. These limitations should be carefully considered when interpreting results and applying findings to design empathetic and user-centered technologies.

The abundance of self-assessment and observer-assessment tools in empathy research within HCI/CSCW reflects a field committed to exploring empathy from various angles. The use of both standardized and specialized measures highlights researchers' dedication to thoroughly investigating the relationship between empathy and technology interactions. Each method contributes unique insights, yet they also present their own challenges. Future studies could greatly benefit

from comparative analyses of these tools, enabling researchers to better understand their strengths and weaknesses in different HCI/CSCW contexts. This depth and diversity of methodological approaches contributes to a more comprehensive understanding of the role of empathy in enhancing user experiences through technology interactions as the field continues to evolve.

4.5.2 Quantitative, Biometric, and Sensory Metrics. These approaches aim to address the limitations of self-reported measures by utilizing objective physiological, neurophysiological, and sensory data.

Biometric Data and Physiological Measures: Various studies have utilized biometric indicators such as heart rate [98], skin conductance [70, 130, 141, 167], pupil diameter [130], and facial temperatures [130] to deduce empathic responses. Frontal asymmetry in the alpha frequency band of EEG measures has also been explored [70]. The synchrony of physiological signals, such as skin conductance, with higher emotional engagement, and expressed in correlations between these signals, has also been studied in interactional settings [141]. Stress and emotions also showcase strong associations with physiological metrics including heart rate and blood pressure [98].

Visual and Auditory Signals: Research has underlined the significance of facial expressions as a robust nonverbal metric for empathy [6, 32, 98, 144]. Beyond the face, studies have emphasized the importance of upper-body framing [115] and other nonverbal cues such as gaze and posture in enhancing the quality of interactions [6, 115, 176]. While auditory signals such as heartbeat rhythms have potential implications for empathic technologies [167], the exact placement of these metrics within the empathy deduction remains to be refined.

Text and Speech-Based Metrics: Recent research has recognized the potential of linguistic elements, speech signals, natural language processing (NLP), and textual input in determining empathy. Techniques have been developed that leverage advancements in NLP to detect levels of empathy in texts [25, 52, 160]. In a related vein, emotion detection has been incorporated into NLP as a subset of sentiment analysis, aimed at identifying empathic structures in textual content [25, 160].

Multimodal Approaches: The convergence of diverse signals such as facial expressions, voice emotion, gestures, and posture enhances empathic understanding. Contemporary research has probed the utility of smartphone usage patterns and Instagram photos for emotion detection [13, 98]. Sociometer badges and adaptive auditory interventions influenced by internal physiological metrics are continually being refined. This includes neuromorphic vision-based systems and frameworks that combines facial expressions with vehicular behaviors for effective emotion detection [98]. Despite their potential, these metrics face challenges including signal noise, context dependency, and physiological variability. Therefore, establishing standardization across different empathic technologies remains critical.

In summary, the developing domain of quantitative, biometric, and sensory metrics exemplifies a shift towards more objective modalities of gauging empathy in HCI/CSCW research. These methodologies harness physiological, neurophysiological, visual, auditory, and textual markers to enrich our comprehension of technology-mediated empathic engagements.

4.5.3 Qualitative Explorations of Empathy. While quantitative methods, including self-assessments, observer assessments, and objective measures, provide essential data-driven insights, qualitative research stands as a vital and standalone approach in understanding the complexities of empathy.

In our analysis, we examined 28 studies [1, 11, 19, 51, 54, 78, 80, 85, 86, 90–92, 94, 95, 101, 102, 113, 118, 122, 128, 143, 150, 153, 154, 163, 165, 166, 175] that employed qualitative methods such as interviews, focus groups, and thematic analysis to explore empathy within the HCI/CSCW

domain. This approach is notably prevalent in investigations involving specific populations such as children, elderly, or those with special needs, possibly due to the deep understanding required in these contexts. For instance, studies focused on enhancing children's empathic abilities [11] and empathic design for dementia patients [19] relied heavily on qualitative insights, since as there are fewer measurement tools available for self-reports (e.g., a specific tool for children) and quantitative metrics and the contexts may not be suitable for the use of these tools.

In this collection, there is a recurring theme of how interactive designs and systems can prompt or evoke empathetic reactions. For instance, when exposed to empathic feedback, children demonstrated varied responses ranging from indifference to a desire for social interaction [11]. In another study, the quality of peer interviews was assessed based on the depth of empathic understanding achieved [102]. The capacity of technology to elicit warmth and care in human users was emphasized in several studies. Participants felt a sense of warmth when receiving signals of care from others [91] and reacted with care and empathy when interfaces displayed signs of distress [24]. Additionally, the ability of human coaches to express empathy and establish human connections was unmatched, suggesting the invaluable role of genuine human-to-human interaction in eliciting empathy [110]. Furthermore, designs that incorporated person-centered dialogue seemed to foster the illusion of cognitive and emotional awareness, making the technology appear more empathetic [138]. The qualitative exploration also revealed the potential for technology to act as a medium for users to reflect on and understand the emotional states of others, which in turn could lead to closer relationships and deeper understanding [78]. These qualitative approaches tend to offer "*thick descriptions*" [100] that enrich our understanding of human behavior, emotion, and cognition in the context of HCI/CSCW.

It is important to recognize that both qualitative and quantitative methods have their distinct strengths and limitations. While qualitative research may face challenges in generalizability and subjectivity in interpretation, these aspects also contribute to its depth and contextual richness. Similarly, quantitative research, though often perceived as objective, is not free from its own forms of subjectivity and interpretive biases.

In addition to these limitations, we also noticed that some studies within our review make claims about increased empathy without robust evidence [24, 48, 94, 110, 159, 174]. This highlights the need for careful interpretation and presentation of qualitative data, a need for standardized approaches, ensuring that claims are well-supported and acknowledging the inherent subjectivity in these interpretations.

Overall, the reviewed qualitative studies provide valuable insights into the different components of empathy within HCI/CSCW. They also suggest potential long-term implications for design interventions aimed at fostering empathy, thereby serving as a fertile ground for further exploration.

4.6 Mechanisms for Inducing Empathy

Inducing empathy within HCI/CSCW involves a multi-dimensional approach that incorporates both technological and human elements. Although most studies focus on experiential routes to engender empathy, such as proxy users, collaboration, and perspective taking, there is also a growing body of work that examines more objective and measurable components, such as expressive biosignals and visuals. By understanding these mechanisms, HCI/CSCW researchers and designers can create more empathetic systems. The following sections provide an overview of the most prominent mechanisms for inducing empathy, with a focus on empirical findings.

4.6.1 Empathy Through Experience. One of the most compelling ways to induce empathy in HCI/CSCW is through experiential methodologies [7, 12, 29, 41, 53, 72, 76, 80, 82, 84, 85, 91, 112, 139, 165]. Having a similar experience to what another person is going through seems to increase

levels of empathy. Some studies have shown that people with experiences similar to a target situation find it easier to take the target's perspective [112]. Lee et al. [91] have illustrated this phenomenon in a study where one person can turn on a cooler fan for another remote person who does not have a control on their device. In this study, the authors found that participants who previously had the difficult experience of heat, turned the device on for longer periods of time because they were aware of how prolonged exposure to cold winds provided a pleasant experience [91]. This suggests that past experiences can inform future empathic actions. Furthermore, the use of software systems that emulate specific conditions is also gaining traction. For example, Aphasia Characteristics Emulation Software (ACES) allows people without aphasia to experience the language-distorting effects of the disorder [53]. Not only does this put them in the other person's shoes, it also has the potential to serve as a training tool for healthcare professionals. This aligns with the general trend in HCI/CSCW towards "*empathy training*" through experiential understanding, such as role-playing scenarios [1, 72].

Another study suggests that sharing stressful experiences allows instant venting and support among people with similar experiences [29]. The feeling of "*I'm not the only one*" plays a significant role in this, providing a sense of relief and community support.

4.6.2 Situational Awareness and Emotional Reactivity. Situational awareness also plays a role in inducing empathy. People are more likely to offer help if they are aware of the suffering of others [29, 172]. This awareness seems to trigger an emotional reactivity, leading to empathy. However, it is essential to note that previous experiences could serve as a primer for situational awareness and thereby induce helping behavior [12, 172].

4.6.3 Collaboration and Information Sharing. Empathy can be induced through collaboration. As noted by Chen et al. [26], providing mutual access to shared information can lead to heightened empathy levels among collaborators. Collaboration, therefore, goes beyond being just a tool for team dynamics and serves as a conduit for fostering empathy.

In particular, in asymmetric collaborative scenarios—where team members have a variety of ways to visualize and interact with virtual content [26]—such collaboration tends to be even more impactful. The inherent disparities in information and interactive capabilities prompt users to share their individual data and understand each other better, consequently amplifying empathy and closeness [26]. This form of collaboration not only brings team members closer in terms of understanding, but also creates an environment where they are attuned to the feelings and perceptions of others, adjusting their actions, and achieving perspective-taking progressively. This observed trend aligns with prior studies suggesting that the richness of information shared plays a crucial role in enhancing a team's communication effectiveness [26].

4.6.4 Physiological Synchrony and Biosignals. Physiological synchrony refers to the concurrent physiological responses exhibited by two or more individuals during shared experiences, with research indicating its association with empathy [70, 141]. For example, electrodermal activation (EDA) synchrony during conversations has been observed to be associated with high emotional engagement of the participants [141]. The importance of physiological synchrony is further underscored by the revelation that real-time feedback on such synchrony could improve empathy training, especially in areas such as leadership, medical training, and autism therapy [141]. Moreover, studies suggest that expressive biosignals, when properly displayed, can influence the empathic response of a user [167]. This is highlighted by the findings that auditory heartbeats can produce interpersonal affective responses similar to common social signals such as gaze and interpersonal distance [167].

4.6.5 Facial and Physical Expressions. The communication of empathy in human interactions is greatly enhanced by non-verbal signals, including facial expressions, posture, and eye movements [116]. Ekman and Friesen's Facial Action Coding System [47] (see [162]) suggests that certain facial expressions are reliable indicators of an individual's emotional state. Moreover, 3D heads have been used to display empathic emotions, further reinforcing the vital role facial expressions play in conveying and inducing empathy [117]. Studies on facial mimicry indicate that all modalities, including facial expressions, posture, vocal utterances, and hand gestures, contribute to empathy perception [176]. In addition, the expressiveness of facial expressions during narrative storytelling has been shown to enhance the emotional impact on the audience [134].

4.6.6 Visual and Auditory Stimuli. Empathy can be induced through various visual and auditory stimuli. The use of emotion cards and visual databases to represent different emotions has been noted in the context of e-learning [75]. Additionally, auditory stimuli, such as heartbeats, have been shown to produce levels of emotional convergence and affect interpersonal affective responses [167]. Presenting heart-rate information alongside interviews has also been found to increase empathy, emphasizing the importance of integrating physiological data with visual or auditory cues [97].

4.6.7 Storytelling and Elicitation of Experiences. Storytelling has long been recognized as an effective tool for developing emotional intelligence and empathy [19]. Through stories, audiences can vicariously live the experiences of characters, deepening their understanding and empathetic connections. Stories such as "Jack and Jim," which explore themes of emotions, empathy, and diversity serve as effective mediums to introduce and discuss empathy [19]. Furthermore, eliciting stories and experiences is not only crucial for empathizing, but also provides designers with insights to respond and design with empathy [7].

In conclusion, while experiential methods of inducing empathy remain dominant in HCI/CSCW, the integration of physiological synchrony, facial and bodily expressions, auditory and visual stimuli, and storytelling provides a holistic approach.

4.7 Addressing the Research Questions

In this scoping review, we aimed to examine the existing research on empathy within the field of Human-Computer Interaction (HCI) and Computer-Supported Cooperative Work (CSCW). By synthesizing the various definitions, methodologies, findings, and trends, we sought to provide a coherent understanding of empathy's role and implications in the HCI/CSCW landscape. Here, we address each of our research questions, highlighting the key insights gained from our analysis.

RQ1: What are the various interpretations and definitions of empathy within HCI/CSCW, and how do these differing perspectives influence the design and evaluation of empathetic technologies and systems?

Our review highlighted that empathy in HCI/CSCW is a complex construct that lacks a universally accepted definition (see Section 4.2). Interpretations of empathy ranged from the ability to understand and interpret the experiences of others, to putting oneself in another's shoes, to an affective response to another's situation. These different perspectives influence the design and evaluation of empathic technologies by shaping the goals, methods and metrics used. For example, studies focusing on cognitive empathy may prioritize technologies that facilitate perspective taking, while those emphasizing affective empathy may focus on emotional resonance and contagion. The lack of a consistent definition and complex granularity of the concept pose a challenge for the effective operationalization and evaluation of empathy in HCI/CSCW contexts.

RQ2: What are the prevailing methodologies, findings, and trends in studies focusing on empathy within HCI/CSCW?

Our analysis identified a wide range of methods used to measure and capture empathy in HCI/CSCW (see Section 4.5). These included self- and observer-assessed surveys, quantitative biometric and sensory metrics, and qualitative explorations (Figure 4). While self-assessed surveys are a common methodology in empirical studies, there is a growing trend in these studies is to integrate multidisciplinary approaches to better capture specific facets of empathy. This trend illustrates a growing recognition of the need for robust tools to effectively measure and analyzes empathy, thereby improving the design and functionality of empathetic technologies in various social and interactive settings. On the other hand, while the other fields (e.g., psychology and clinical research) may provide various tools, the integration of these tools into HCI/CSCW research requires further deliberation. In addition, our scoping review shows that inducing empathy in HCI/CSCW often involves experiential methods such as storytelling and immersive simulations, closely aligned with emerging practices that incorporate real-time feedback and physiological synchrony to enrich empathetic interactions and training (see Section 4.6). These methods show promise in supporting deeper user understanding and engagement by allowing users to experience and reflect on emotional states similar to those they are being asked to empathize with.

RQ3: What roles does empathy play in HCI/CSCW in various contexts?

We identified five key roles that empathy plays in HCI/CSCW in different contexts (see Section 4.4). These include: *1)* facilitating empathy between users to enable social connection and collaboration, *2)* enabling designers to empathize with users to create user-centered designs, *3)* encouraging users to empathize with artificial agents to enhance interaction and engagement, *4)* designing agents that users perceive as empathetic for emotional support and trust, and *5)* developing agents that can understand users' situations without necessarily being perceived as empathetic. These highlight the diverse roles and future categorization of empathy in improving human-computer interactions, guiding design processes, and enhancing user experiences in domains such as healthcare, education, accessibility, and virtual environments.

5 Discussion

Building upon this groundwork, in this section, we expand on several under-explored dimensions of empathy in HCI/CSCW. From the importance, potentials and drawbacks of empathy, collective *vs.* individual focus, empathy and diversity, empathic intentions *vs.* real-world outcomes, emotional mimicry and social context, to attentive curiosity *vs.* emotion recognition, and gender and cultural differences, this section reveals different stances on empathy in HCI/CSCW and provides potential paths for the future work.

5.1 With Empathy, For Empathy

The critical exploration of empathy in HCI/CSCW and design has underscored its significance in numerous contexts. For instance, a rather disturbing observation from recent research indicates a noticeable decline in empathy scores over the years. Specifically, empathy levels among US college students have witnessed a substantial decline, falling by over 30% from 1979 to 2009, with an even more rapid decline from 2000 to 2009, as mentioned in [75, 84, 160]. This downward trajectory extends beyond the academic environment to include the medical and nursing fields, where decline in empathy levels of up to 50% have been reported [75]. Considering the gravity of this situation, global bodies such as the Organization for Economic Cooperation and Development (OECD) emphasize that cultivating empathy skills should be given paramount importance in contemporary higher education [160]. As a result, research on empathy and its meaningful elicitation

in interpersonal interactions and collaborations—often mediated by technology—needs critical reflection, including an examination of how it is currently understood and applied in HCI/CSCW.

Researchers and practitioners in these fields and HCI/CSCW are increasingly concerned about how these societal changes affect interpersonal relationships and communication, particularly in technologically mediated environments. These concerns are often translated, without reflection or analysis of their broader societal implications, into a greater need for tools that can effectively promote empathic understanding and interaction to counteract this trend. This has led to a surge in research aimed at understanding, inducing and applying empathy through technology, which is seen as a potential buffer against the wider societal decline in empathetic engagement. Expressing genuine empathy is associated with favorable outcomes such as improved coping mechanisms, building trust, maintaining self-esteem, and more [116]. Systems that demonstrate empathic understanding are considered to significantly enhance user affinity towards these systems, elevating user engagement, mood, and comfort [116]. This perspective extends to virtual realms, where companion agents equipped with empathic capabilities may have a potential to substantially improve human-computer interactions [104].

Moreover, incorporating empathy into design and technology applications yields tangible positive outcomes. Empathy-infused healthcare robots, for example, can significantly influence user trust and satisfaction [74], and empathic car interfaces can potentially mitigate emotion-induced hazards in driving [13]. This notion is further validated with studies showing that empathic expressions in dialogue systems can alleviate user boredom and enhance user satisfaction [172], while empathy-based interventions, even in shared virtual reality spaces, can support social presence and even drive healthier behavioral changes [70].

From facilitating harmonious human-computer interactions to redefining the user experience paradigm, empathy stands at the intersection of technology and human-centered design. However, as we move forward with technology and empathy, it is necessary to continually evaluate and redefine the boundaries and ethics surrounding this relationship. These ethical considerations regarding the broader role of empathy in HCI/CSCW, particularly as it relates to the emerging notion of empathy-centered design, have been at the forefront of evolving discourses in HCI/CSCW seeking to develop a meaningful future research agenda in three consecutive workshops organized at CHI in recent years [40, 43, 103].

5.2 Considerations on Empathy

While the importance of empathy in HCI/CSCW and design cannot be understated, particularly given its role in the promotion of positive psychological, physical, and health outcomes [116], several concerns and challenges need to be addressed to effectively incorporate empathy.

First, there is a pressing need to address the potential negative implications of empathy in digital spaces. Choi et al. [29] underscore the sense of accountability formed in digital platforms. Users of their platform, StressTrendmeter, felt compelled to offer supportive comments to peers who added their posts on to the platform, concerned that the latter group might feel discouraged by the lack of empathetic engagement. This observation reveals a new dimension to the challenges of digital empathy – where users feel obligated to engage empathetically, potentially leading to emotional burnout. Another noteworthy point is the phenomenon of emotional contagion, wherein negative emotions such as stress or depression can spread among viewers on social media platforms [29]. There is also a growing concern about regarding the potential empathic awareness of chatbots, with concerns that these might be easily manipulated to exert emotional influence on users [149]. Furthermore, inferring on the basis of observed data, such as video, can be difficult. One cannot simply infer exact emotions or behaviors without taking into account multiple aspects such as scene understanding and the relative positioning of different actors [130].

Moreover, the debate over human empathy toward machines highlights that traditional empathy functions primarily within the boundaries of human societies and thrives on the intrinsic similarity between self and others. Thus, the argument arises that human empathy toward computational systems may be a logical misstep [112].

Empathic or empathy-centric design, particularly for marginalized or disabled communities, is rife with its own challenges [12]. The 'empathy trap' [174] highlights the issue where, despite good intentions, designers might fall prey to their preexisting biases or stereotypes, thereby reinforcing them instead of challenging them. Moreover, the practice of empathy in design processes, including role-playing, simulation, or the creation of personas, can sometimes inadvertently create a divide between designers and the target group, especially the disability community [12]. Such exercises may offer designers a comforting distance that subtly disregards the actual experiences of those for whom they are designing [12]. The privacy and trust issues further complicate the matter. Emotions are inherently private, and although this has been considered important in only a few existing studies, not all users are reportedly comfortable with their emotions being shared and perceived by others, even if they are positive [54]. Trust in computational systems remains an overlooked concern, with some users expressing skepticism that sensors can accurately measure their emotions and experiences [54].

In essence, while empathy offers significant benefits in and for HCI/CSCW and design, careful consideration is needed to avoid its potential pitfalls. Embodying empathy in the design process for the sake of embodying empathy can lead to unfavorable outcomes for target audiences, rather than enhancing their experience. In addition, we emphasize that embodying empathy in design and HCI/CSCW is not simply about incorporating an emotion or state, but about understanding its complexities and being mindful of its challenges.

5.3 Different Stances on Empathy in HCI/CSCW and Future Directions

In this section, we provide diverse perspectives on empathy in HCI/CSCW. From the need for collective empathic designs to the intricacies of cultural and gender differences, this discussion aims to highlight the current state of empathy in HCI/CSCW and the areas that guide further exploration.

5.3.1 Varied Approaches and Acts of Empathy. Understanding empathy in HCI/CSCW requires recognizing the different agents and contexts in which empathy operates. Our findings identify three primary foci of empathy: researchers/designers, user groups, and (empathic) technologies. This diversity of empathic agents suggests tailored approaches and strategies for inferring and inducing empathy in HCI/CSCW environments. For researchers and designers, empathy involves deep engagement with and understanding of user experiences in order to make more sensitive and inclusive design decisions. On the other hand, empathy between user groups can enhance collaborative efforts, improve communication dynamics, and strengthen community bonds. Technologically mediated empathy, represented by empathetic agents or systems, not only increases user engagement, but also supports emotional well-being and satisfaction by providing responsive, context-aware interactions.

Systems that recognize and adapt to users' emotional states can transform the user experience, making technology interactions more supportive and understanding. Similarly, empathy training tools for designers can lead to more user-centered products, while platforms that facilitate empathetic exchanges between users can enhance social connectivity and support. Thus, the operationalization of empathy in HCI/CSCW should be diverse, reflecting the complex nature of its actors. By expanding the scope of empathy to include these diverse approaches, HCI/CSCW can better address the broad needs and challenges of its increasingly diverse user base.

5.3.2 Collective Focus Over Individual Focus. Traditional paradigms in HCI/CSCW have prioritized the experience and needs of individual users, underestimating the role of empathy in group interactions. While, most of the studies in our review focus on individual aspects of the empathy, few of them focus on dyadic (e.g., [26, 61]) or group dynamics (e.g., [102]). However, what's missing is an understanding of how to foster empathic connections in collaborative settings. Instead of focusing on individual empathic experiences, there needs to be a transition towards a more collective focus that includes group dynamics, shared empathic experiences, and collective well-being. This could pave the way for empathic design considerations in collaborative digital environments such as online classrooms or remote workspaces.

5.3.3 Empathy and Diversity. The focus on empathic design within HCI/CSCW has been dominated by perspectives and philosophies attuned to the global West, while overlooking the complex, intersectional nature of empathy across cultures, genders, ages, and abilities. The role of gender and culture in shaping empathic interactions remains underexplored in the HCI/CSCW literature [76]. Empathy is not universally expressed or experienced; it varies significantly across cultures and genders. Ignoring these differences can lead to designs that are at best ineffective and at worst perpetuate harmful biases and stereotypes. A critical re-evaluation of HCI/CSCW's approach to diversity in empathy is essential. An empathic system must adapt and be adjusted to various user groups, avoiding a "*one-size-fits-all*" paradigm that risks perpetuating stereotypes. This requires a commitment to ethical design practices that honor diverse expressions and understandings of empathy.

5.3.4 Empathic Intentions vs. Real-World Outcomes. The gap between empathic intentions and actual outcomes in artifacts manifested at the intersection of HCI/CSCW and design disciplines is noteworthy. A system designed to be empathic in theory may fall short in the messy context of real-world human interactions. Therefore, it's essential for future HCI/CSCW research to scrutinize the real-world efficacy and resilience of supposed empathic features or designs, through longitudinal studies or similar methodologies.

5.3.5 Emotional Mimicry and Social Context. Technological mimicry of empathic signals—e.g., tone modulation in voice assistants—is often conducted without adequate consideration of the social context. Empathy is highly dependent on the surrounding social environment and requires an understanding that goes beyond mere mimicry. Future work in HCI/CSCW should therefore strive to create context-aware empathic systems that understand the complexities and differences of interpersonal social interactions.

5.3.6 Looking Beyond Emotion Recognition. Current empathic systems in HCI/CSCW rely primarily on emotion recognition (e.g., [31, 32, 176], but empathy is not just about recognizing or sharing emotions. Instead, it is manifested as a conscious effort to understand and immerse oneself in the situation and emotional state of others, and to find ways to respond appropriately to those situations. The notion of "attentive curiosity" refers to an active, exploratory form of empathy that seeks to understand the user deeply. This dimension of empathy has been largely overlooked in HCI/CSCW and could offer transformative ways for empathic design.

In conclusion, the field of HCI/CSCW has yet to fully address the complex nature of empathy, from its collective manifestations to its diversity across cultures and contexts. A more nuanced understanding of empathy, enriched by real-world data and ethical considerations, can support more effective and inclusive empathic systems.

5.4 Limitations

In conducting this scoping review, we adopted certain strategic decisions to provide a focused exploration of the topic. Our primary literature source was the ACM Digital Library, which allowed us to concentrate on key contributions within this platform, though we are aware that other databases may provide additional perspectives. We strategically selected "`empathy`" as our central keyword, recognizing its growing prominence in the HCI/CSCW domain. Although closely related terms like "`sympathy`," "`affective computing`," and "`compassion`" are certainly of interest and can offer complementary insights, our study aimed to anchor its insights on a singular, yet multifaceted, and nuanced term. As a result, while we believe that our findings offer a robust and deep insight into the role of empathy in HCI/CSCW, they should be interpreted with these limitations in consideration.

6 Conclusion

Our scoping review of 121 papers from the ACM Digital Library emphasizes a fragmented understanding of empathy and reveals both the potential and the challenges of leveraging empathy to guide the design processes as well as to shape the design of—empathic, interactive, and intelligent—technologies and systems. We have identified key roles of empathy in HCI/CSCW: enhancing empathy among users, enabling empathy from designers towards users, encouraging users to empathize with artificial agents, and designing empathic artificial agents.

With this review, we reveal significant gaps in the current understanding and application of empathy within HCI/CSCW: *1)* a lack of consensus on the definition and theoretical underpinnings of empathy, with interpretations ranging from the ability to understand experiences of others to an affective response to another's situation. This absence of a standardized conceptualization hinders the effective operationalization and evaluation of empathy in HCI/CSCW contexts; *2)* despite the variety of methods used to gauge empathy, the predominant approach remains self-report instruments, highlighting the lack of novel, rigorously established, and validated measures and methods to capture the specific facets of empathy; and finally, *3)* empathy in HCI/CSCW is often viewed through an individualistic lens, which overlooks the broader, collective experiences that occur in digital environments. There is a critical need to expand empathy research to cover these collective experiences, which could lead to more inclusive and culturally sensitive technology designs.

In addition, this scoping review contributes to the development of a fundamental understanding of the impact of empathy not only on user engagement and satisfaction, but also on ethical technology design in terms of respecting and enhancing human dignity and diversity across cultures, genders, ages, and abilities to avoid perpetuating harmful biases and stereotypes. It calls attention to the risk of reinforcing harmful biases and stereotypes when empathy is not appropriately utilized to either guide the design process or inform the design of technologies and systems. Our research also argues for the importance of assessing the real-world impact of technologies that claim to be empathetic through comprehensive, longitudinal studies. These should go beyond simple emotional mimicry to include context-aware, empathetic systems that truly enhance the user experience.

Finally, this scoping review serves as both a reflection and a road map, identifying the gaps, challenges, and opportunities for future research. The goal is to provide academics and practitioners with a foundational understanding that meaningfully informs designers and researchers on the design of empathetic technologies, systems, and methodologies. By addressing these gaps and embracing the complexity of empathy, HCI/CSCW researchers and practitioners have an opportunity to significantly enrich human experiences in our increasingly digitized world.

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