A Scoping Review of Ethics Across SIGCHI

Nunes Vilaza, Giovanna; Doherty, Kevin ; McCashin, Darragh ; Coyle, David; Bardram, Jakob ; Barry, Marguerite

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Giovanna Nunes Vilaza
Technical University of Denmark
Kongens Lyngby, Denmark
gnvi@dtu.dk

Kevin Doherty
Technical University of Denmark
Kongens Lyngby, Denmark
kevdoh@dtu.dk

Darragh McCashin
Dublin City University
Dublin, Ireland
darragh.mccashin@dcu.ie

David Coyle
University College Dublin
Dublin, Ireland
d.coyle@ucd.ie

Jakob Bardram
Technical University of Denmark
Kongens Lyngby, Denmark
jakba@dtu.dk

Marguerite Barry
University College Dublin
Dublin, Ireland
marguerite.barry@ucd.ie

ABSTRACT

Ethical deliberation has proved a consistent feature of Human-Computer Interaction (HCI) since its earliest years, spanning the respectful involvement of research participants to design choices impacting fairness, freedom and welfare. Despite growing discussions, applied knowledge and practical approaches for navigating complex moral dilemmas remain challenging to grasp. Motivated by the need for a structured overview, this paper contributes a scoping review of ethics as discussed across 129 full-length SIGCHI papers containing the search term 'ethic*' in their title, abstract or authors' keywords over the last ten years. Findings show increasing prioritisation of the topic, particularly within Artificial Intelligence. Value-Sensitive and Critical Design appear as the most frequently applied orientations, and participatory approaches are more prevalent than those without end-user input. Engaging with a spectrum from personal to societal concerns, the SIGCHI literature thus echos calls for critical perspectives on user-centred processes and the need to establish more sustainable responsibility structures.

CCS CONCEPTS

• **Social and professional topics** → **Codes of ethics**; • **Human-centered computing** → *Interaction design process and methods*; • **General and reference** → Surveys and overviews.

KEYWORDS

Ethics; Design Research; Scoping Review.

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1 INTRODUCTION

As digital technologies have expanded their capacity to affect human lives at ever-increasing scales and in ever more intimate ways, the accompanying ethical dilemmas have grown only more prevalent: algorithmic bias, political interference, disinformation and hate online, the misuse of personal data and deceptive interfaces [36]. Researchers and practitioners working with technology design are thus increasingly required to pursue an open and informed engagement with ethics as they search for guiding references to drive responsible choices in relation to complex questions of individual and collective values, power-knowledge asymmetries, and the legal and societal implications of technological innovation. In terms of actions and behaviour, applying ethics in practice has been said to ultimately "require consideration of how to treat others, and what becomes of others and oneself in addressing intermediate problems" [175]. In the daily work of technology creation, adoption and adaptation, ethics, therefore, entails remaining responsive to the futures enabled through design and research decisions [60, 141].

Significant efforts have promoted the discussion of ethics within academia as means to support ethical work. Conference panels and workshops on the topic have maintained a regular presence since the very first HCI conferences [111], and ethics remains highlighted as one of the most important concerns of HCI today [149]. The ACM Code of Professional Conduct and the IEEE Code of ethics reflect this broad recognition of the prominent role of ethics through formal sources of guidance, advocating, for instance, that computing professionals should avoid causing harm and ensure that the public good is a central goal [64, 80].

Furthermore, a few authors conducted systematic reviews within specific application contexts, examining, for instance, how different ethical theories have been used to program autonomous machines [157]. Other authors have systematically characterised which ethical issues and arguments have been associated with brain-computer interfaces [23], robots for aged care [166] and assistive technologies for dementia [81]. Van et al. have also revised mentions of the keyword 'ethics' across the ACM Interaction Design and Children Conference (IDC) [165]. In contrast to these reviews focused on particular technology domains, a much broader systematic review from 2016 has previously analysed Computer Science journals in order to extract insights into how computing ethics has been discussed by this particular section of the literature over the years [148].

While providing essential guidance, these past efforts in the form of systematic reviews have gaps. First, the search query used in the broader review of computing ethics from 2016 has not captured papers published in important HCI venues, such as CHI and

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DIS [148]. As HCI is at the centre of much ethical reflection concerning technology's design, use, and implication, this is a critical gap to address. Second, the other past reviews have focused specifically on certain technology domains (for example, machine learning), which means they do not provide a comprehensive overview of ethical engagement across computing technologies as a whole. A systematic review of ethics across multiple HCI venues, including a diverse set of technology domains, could not only fulfil these gaps but, most importantly, provide general and informed advice on possible routes to action.

Motivated by the identified research gaps and the pressing need for knowledge resources among individuals working towards more robust engagement with ethical technology development and design, we conducted a scoping review. For this review, we targeted full-length papers published at conferences sponsored by the ACM Special Interest Group on Computer-Human Interaction (SIGCHI) containing the search term 'ethics*' in their title, abstract, or authors' keyword list. To be clear, instead of aiming to capture all papers about ethics within HCI, we sought to coherently, systematically and transparently identify a representative sample of papers discussing ethics in detail as a core focus of their HCI work in the last ten years.

Therefore, the main goal of this review is to provide a rigorous account of the landscape of ethics discussion across SIGCHI in order to support technology creators, designers and researchers looking to fortify orientations towards ethical thinking and doing. We carry out this work from the position of HCI, Software Engineering and Information Science Studies academics, ranging from all levels of seniority, seeking to learn possible pathways for conceiving technologies that are not only user-friendly but ethically informed. Hence, the following research questions drive this scoping review:

(1) Which ethical considerations, technologies and user groups have been the subjects of ethical engagements?
(2) Which approaches, methods and theories have been employed to explore ethical considerations?
(3) What practical recommendations for putting ethics into action have been reported and discussed?

In summary, this paper contributes a systematic and coherent overview of 'ethics' as provided by articles published at SIGCHI-sponsored conferences. The importance of such a timely review stems from the argument that without a substantial commitment to ethics, the future of interactive systems design and research might fail to prioritise fundamental aspects of human existence, such as freedom, fairness and welfare [117]. As the SIGCHI conferences represent key, aggregate spaces for precisely such questioning and debate, this scoping review aims to help chart a growing discourse - and range of actions - around ethics within HCI to inform the work of designers, artists, psychologists, user experience researchers, systems engineers, and many other professionals. Next, we describe and motivate our choice for a scoping literature review methodology. Then, we present the findings gathered through the identified sample of papers, followed by a discussion of the implications and limitations of the results, as well as directions for future work.

2 METHODOLOGY

Seeking to provide a comprehensive account of HCI publications that could support professionals in their ethical practice, we identified and analysed relevant literature sources about ethics through a scoping review methodology. A *scoping review* is a rigorous literature review procedure that produces a systematic description of previous research about a topic, refraining from judging the quality or weight of evidence provided by individual papers. It is an effective method for identifying knowledge gaps and clarifying concepts across a body of literature and an ideal methodology to initially appraise the field (in contrast to traditional reviews where evidence is critically evaluated) [115]. This review follows the established scoping review procedure of Arksey and O'Malley [4] and reports the review procedure and its results using best-practice items recommended by the latest version of the Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for Scoping Reviews[1] (PRISMA-ScR, 2018) [160].

2.1 Eligibility Criteria

Using the ACM Digital Library search filter 'sponsored by' SIGCHI (Special Interest Group on Computer-Human Interaction), we searched for publications containing the keyword 'ethic*' within the title, abstract or authors' keywords. Employing the wild card * means that any word starting with the letters 'ethic' was included in our search results (e.g. ethical, ethics or ethically). Only peer-reviewed, full-length archival publications were eligible for inclusion: a standard literature reviewing practice to ensure the analysis of mature work. Another eligibility criteria consisted of considering papers published from January 1st 2010, to December 31st 2020, in order to gather an overview of the last ten years of research in the field without missing a substantial number of sources (for instance, a search for CHI publications with the keyword 'ethic*' within the title, abstract or authors' keywords resulted only in 9 full-papers, with the first one being from 1993). These eligibility criteria were driven by the need to produce a rigorous overview of ethics within a transparently delimited, reproducible and manageable scope. See Section 4.5 for more detailed reflections on our rationale.

2.2 Information Sources

The ACM Digital Library was our sole information source. We did not contact other authors to identify additional sources. Our most recent search of the ACM Digital Library was conducted on January 27th 2021.

2.3 Search Query

The full query syntax used for the ACM Digital Library search was: *"query": Title:(ethic*) OR Abstract:(ethic*) OR Keyword:(ethic*) "filter": Sponsor: SIGCHI,Publication Date: (01/01/2010 TO 12/31/2020),ACM Content: DL.*

[1]The PRISMA-ScR [160] is a standardised guideline for the description of scoping review procedures based on the framework outlined by Arksey and O'Malley [4].

2.4 Selection of Sources of Evidence

The initial sample produced by the query search was screened to ensure the sole inclusion of peer-reviewed, full-length archival publications. Then, based on the main research questions presented in Section 1, the authors agreed upon a concise set of exclusion criteria. Papers that, despite mentioning ethics in the title, abstract or authors' keywords, did not engage with the term in the main text would be removed from the sample. Papers using the term ethics to refer to a body of values governing a particular culture or group but not directly addressing technology ethics (for example, hunting ethics) would also be removed, as would those only very briefly mentioning the word ethics to justify their chosen research approach without reflecting on ethical considerations to any significant extent within the main text. These criteria were applied to all sources of evidence initially identified, leading to the removal of papers fulfilling any of the above conditions.

2.5 Data Charting Process

Regarding the methods of charting data from the included sources of evidence (for example, whether data charting was done independently or in duplicate), the first and second authors discussed and agreed upon a set of predefined data items to be extracted from each paper, based on the overarching research questions listed in Section 1. The first author then charted the data items from the complete set of papers using a spreadsheet, and the third author independently charted 10% of papers in a separate spreadsheet to validate the charting process. There were no substantial disagreements at this stage. Then, the second author independently reviewed the data-charting spreadsheet and collaboratively iterated upon the results with the first author in order to resolve any disagreements.

2.6 Data Items

Driven by the research questions listed in Section 1, the following predefined data items (codes) were extracted from each paper and organised using a spreadsheet:

- characteristics of sources of evidence:
  - publication year (for example, 2020)
  - publication venue (for example, DIS)
- subject matters of ethical considerations:
  - ethical concerns (for example, privacy invasions)
  - technology types (for example, public displays)
  - groups of end-users (for example, children)
- approaches to ethics in design and research:
  - empirical approaches (for example, focus group)
  - theoretical approaches (for example, Value-Sensitive Design)
- recommendations for putting ethics into action

The first author manually carried out the extraction of each of these above-listed data items for each paper. Whilst the information required for most items could be straightforwardly labelled (for example, year and publication venue), a small number of data items presented multiple naming possibilities (for example, child users could be subdivided into toddlers, preschoolers, middle childhood and young teens). When this was the case, the authors chose to adopt a less complicated and broader classification, leading to fewer sub-categories in the final dataset. The naming and grouping of those charted data items followed an iterative and inductive approach in the form of the knowledge synthesis process described next.

2.7 Synthesis of Results

The method chosen for handling and summarising the data charted followed the established approach widely considered appropriate for scoping review methodologies, as it entails "identifying prominent or recurring themes in the literature (largely shaped by research questions) and summarising the findings of different studies under thematic headings", which is considered well-suitable for scoping review methodologies [86]. In particular, results from charting the data items regarding 'ethical concerns', 'technology types', 'end-user groups' and 'ethical recommendations' were classified according to key conceptual categories, as recommended when collating, summarising and reporting results [4]. As seen in the previous sub-section, these categories were produced by grouping related findings through an iterative approach without employing predefined taxonomies as guides.

For example, multiple 'recommendations for putting ethics into action' were identified and collected in the data chart first. Then, three broad groups were inductively formed based on conceptual affinity of the complete set of recommendations (ethical participation in research, design choice or taking responsibility). Within each group, the recommendations of each paper (or sometimes more than one paper) were further grouped and depicted in narrative form emphasising prominent or recurring themes (for example, 'it is recommended to revisit informed consent procedures throughout projects'). When relevant, relationships between findings were highlighted and summarised in descriptive text form (for example, the connection between technology types and specific ethical concerns). As explained in Section 2.5, the first author carried out most of this process independently, while the second and third authors checked on the first author's work at later stages, each making iterative passes through the aggregated labels.

For summarising the charted data, we employed tables and data visualisations to illustrate the distribution of sources of evidence (papers) by publication year and venue. We similarly produced tables to show the distribution technology types, end-user groups and empirical methods for approaching ethics present within the sample. Next to these tabulated results, a descriptive summary in text form explained how these results related to the review questions. Findings from all the other data charting items were reported in descriptive narrative form. The results of this knowledge synthesis are detailed next.

3 FINDINGS

Following PRISMA-ScR [160] for the reporting of scoping review results, we first present the process of selecting sources of evidence. We then describe the characteristics of these sources of evidence in terms of publication venue and year. And finally, we present the synthesis of the results answering each research question.

3.1 Selection of Sources of Evidence

The search query employed resulted in an initial sample of 461 papers. The meta-data of this set were then screened to ensure the sole inclusion of peer-reviewed, full-length archival publications. This process led to the removal of 314 manuscripts comprising late-breaking works, workshop calls, works in progress, tutorials, Special Interest Group meetings, keynotes, case studies, courses, doctoral consortia, interactivity publications, research landscapes and awards. Pictorials were not removed as they are considered archived, full-length publications at the annual Designing Interactive Systems (DIS) conference.

The remaining 147 full papers were analysed in relation to the exclusion criteria defined in the previous section (See section 2.4). This step resulted in the removal of the following papers: papers that do not engage with the term in the main text (n=5, [69, 71, 106, 142, 181]); papers that use the term ethics only to refer to the values of a group (for example, the ethics of hunting) rather than the ethics of digital technology research and design (n=4, [56, 96, 151, 158]); and papers that mention the word ethics only very briefly to justify research conduct without further engaging with the topic (n=9, [6, 27, 37, 85, 98, 118, 129, 137, 180]). This process resulted in a final sample of 129 papers relevant to our research questions and constituting the complete source of evidence (See Figure 1).

3.2 Characteristics of Sources of Evidence

As described above, the final review sample includes 129 full-length papers published at SIGCHI-sponsored venues (See Table 1). The majority of papers were published in the last three years: 2018 (17%, n=22), 2019 (20.9%, n=27) and 2020 (28.6%, n=37). The years between 2010 and 2017, in contrast, account for only 33.3% of the sample (n=43). The majority of papers within the sample were published at CHI (59.6%, n=77), with the second-largest group of papers published at DIS (22.1%, n=17) [2]. Figure 2 illustrates the distribution of papers across publication venues and years.

3.3 Subject Matters of Ethical Considerations

Our first research questions was devised to identify the subject matters of ethical considerations concerning specific ethical concerns, technology types and groups of people across this sample in order to discern predominant and under-explored areas of focus. Several ethical concerns were identified, and we classified these concerns in broad groups that even though do not represent a formal taxonomy, provide a valuable depiction of recurrent themes. Examples of autonomy violations include privacy invasions and lack of data sharing choices [1–3, 7, 9, 18, 21, 22, 24, 28, 34, 35, 54, 58, 63, 78, 90, 93, 97, 99, 108, 109, 113, 116, 119, 122, 124, 131, 132, 138, 139, 144, 145, 154, 156, 159, 163, 165, 169, 170, 172, 174, 177, 178]. Hidden persuasion, often found in 'dark patterns' (malicious user interface patterns), can also be considered disrespectful to autonomy, as these are intentionally employed to engage users in performing actions against their best interests and without their awareness [3, 5, 8, 21, 25, 26, 30–32, 40, 49, 65–67, 79, 84, 90, 92, 95, 123, 125, 131, 133, 134, 140, 163–165, 177]. Harm to integrity and well-being can be identified through evidences of physical and emotional distress [3, 10, 12, 13, 15, 19, 26, 35, 43, 47, 57–59, 75–78, 82, 87, 88, 90, 91, 94, 95, 99, 100, 103, 104, 112, 116, 125, 128, 132, 135, 136, 143, 145–147, 159, 162, 163, 165, 167, 169, 170, 173, 174, 176, 178]. Potential fatal consequences are yet another way individuals can be physically harmed, and their safety is at risk (for example, accidents with autonomous vehicles) [2, 5, 29, 84, 89, 102, 107, 110, 114, 120, 171, 177]). Issues related to social injustice encompass the negative consequences of exclusion, misrepresentation, stigma, bias and oppression [3, 9, 10, 16, 18, 28, 44, 49, 50, 58, 68, 72, 82, 83, 94, 100, 101, 103, 105, 120, 121, 126, 128, 130, 132, 136, 138, 145, 146, 150, 153, 154, 161, 162, 168–171, 176, 178]. Similarly, instances of unethical monetisation practices, such as the selling of data outside its original context are also related to social (un)fairness [7, 24, 30, 31, 40, 42, 53–55, 65–67, 130, 131, 139, 144, 147, 152, 165, 167, 179]. Most papers explicitly mention and name at least one ethical concern, even though a few papers provide more general discussions that could apply to any type of ethical issue [11, 38, 51, 70].

The first research question also sought to identify which technologies and groups of people have been the targets of ethical considerations. Regarding technology types, this sample includes papers discussing ethics in relation to artificial intelligence (AI) applications, mobile and web applications, social networks and forums, the internet of things (for example, smart spaces), public installations and displays, wearables and biosensors (for example, fashion technologies), games, data repositories and broadcast media. AI systems are the most discussed technology type across the sample, with a considerable number of papers focusing on embodied agents (for example, social robots), although other AI applications (for example, recommender systems) are also present (See Table 2). Several papers in the sample do not focus on any technology in particular [1, 11, 13, 16, 22, 44, 57, 59, 70, 72, 75, 77, 88, 94, 109, 112, 116, 143, 153, 156, 165, 169, 170]. Very few papers discuss more than one technology type [58, 91, 145].

Papers tend to focus less frequently on specific end-user groups than on technology types. However, this sample did include papers about children, teenagers, independent workers, patients or individuals with health conditions, minorities, women, older adults, rural populations, researchers and non-human end-users (for example, birds) (See Table 3). The most frequently discussed group of users across this evidence base are children and teenagers, followed by workers. Several papers also targeted intersecting groups such as women with impaired hearing [176] and older adults with dementia [57, 76]. Aside from these papers which discuss ethical considerations in relation to end-users of digital technology products, a further group of papers discuss ethics in relation to research participants and researchers [1, 22, 75, 75, 77, 112, 116, 169, 170], UX professionals [30, 31, 65–67], and students learning about technology design [18, 42, 57, 130, 139].

By examining our results, we were able to identify some relationships between ethical concerns and technology types or groups of end-users. Adverse psychological effects and potential harms to individual well-being are in particular surfaced in relation to studies involving women [12, 58, 176], children [24, 43, 99, 163, 167] and the elderly [26, 35, 95, 174]. Papers discussing these concerns are likewise most often focused on technologies for personal

[2]The complete list of SIGCHI-sponsored conferences is available at https://sigchi.org/conferences/

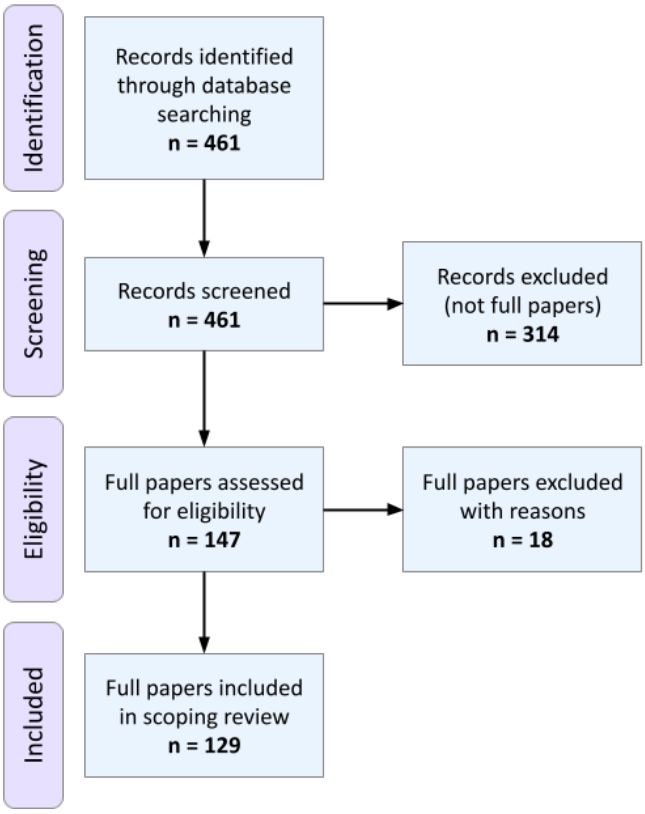

Figure 1: Selection of sources of evidence (flow diagram)

Year	Instances	Venue and References
2010	0	-
2011	3	CHI [8, 104, 125]
2012	4	CHI [15, 59, 113], DIS [35]
2013	8	CHI [19, 70, 82, 108, 112, 169], ECCE [38], PerDis [93]
2014	9	CHI [47, 70, 72, 173], DIS [34, 152], CSCW [53, 103], CHI PLAY [167]
2015	2	CHI [116], HRI [102]
2016	12	CHI [22, 83, 109, 164, 172, 174], DIS [44, 95], CSCW [170], HRI [29, 79, 136]
2017	5	CHI [12, 68], CSCW [21], HRI [5], MobileHCI [123]
2018	22	CHI [2, 50, 54, 63, 67, 78, 94, 100, 105, 121, 144, 145, 153, 156, 168], DIS [176], HAI [133, 171], RecSys [49], AutomativeUI [107], MobileHCI [99], TVX [131]
2019	27	CHI [1, 10, 13, 25, 28, 30, 32, 65, 77, 91, 110, 124, 128, 130, 132, 154, 179], DIS [9, 58, 178], HRI [84, 87, 90, 92, 134], CHI PLAY [147], CHIIR [16]
2020	37	CHI [3, 7, 26, 31, 40, 51, 57, 75, 89, 101, 114, 119, 120, 122, 136, 139, 140, 150, 162], DIS [18, 66, 76, 135, 138, 146, 159], HRI [43, 177], IDC [24, 42, 88, 163, 165], CHIIR [97, 143], VRST [126], HT [55]

Table 1: Publication year, venue and reference number for each source of evidence included within the sample.

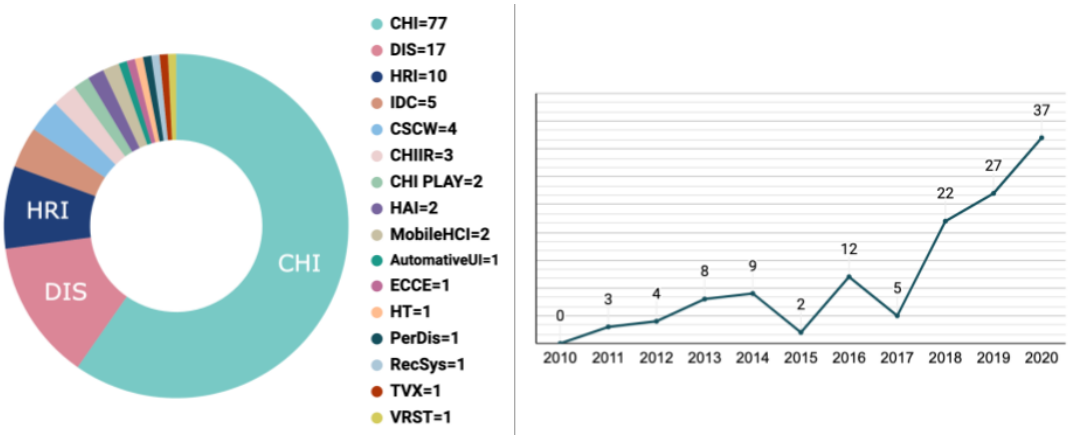

Figure 2: Sample distribution according to the publication venue (left) and year (right).

Technology Types	Instances	References
Artificial Intelligence (AI)	32	social robots [5, 24, 26, 29, 43, 79, 84, 92, 95, 102, 133, 134, 136, 161, 163, 171, 174, 177], autonomous vehicles [107, 110, 145, 179], conversational agents [140, 150], recommender systems [49, 179], facial recognition [178], in general [9, 18, 38, 101, 120]
Mobile and web applications	23	personal health [12, 35, 125, 128, 132, 139, 173], research [21, 108, 113, 123, 146], services [25, 30, 31, 40, 65–67, 100, 130, 145, 164]
Social networks and forums	12	crowd-sourcing [10, 82, 83, 103, 105], social media [3, 28, 50, 54, 99, 144, 145]
Public installations and displays	8	ambient displays [8, 124], installations [15, 25, 47, 89, 93, 172]
Internet of Things (IoT)	7	smart spaces [58, 122, 138, 152], smart TVs [131], educational tools [90], in general [63]
Wearables and biosensors	6	biosensing [34, 58, 78], fashion technologies [159, 176], body integration [114]
Games	6	playful narratives [87], virtual reality [126], for leisure [147], with cultural references [167], with adult content [119], multiplayer [91]
Broadcast media	6	video streaming platforms [42, 53, 55, 143], documentaries [68], news media [91]
Data repositories	5	historical archives [97], DNA repositories [7], learning analytics [154], visualisation [32], in general [145]
Others	5	shape-changing interfaces [2], end-of-life technologies [19, 104], drones [51, 145]

Table 2: Technology types as the target of ethics discussions.

health [12, 57, 76, 132, 159] and games [147]. Safety risks, accidents and the possibility of severe physical hazards of technology use are most often associated with social robots and autonomous vehicle interactions [5, 29, 107, 136, 177].

Concerns regarding privacy invasion and security breaches are most often encountered in contexts involving data collection and sharing, such as mobile and wearable sensing [21, 34, 108, 113, 159], Internet of Things (IoT) devices [63, 90, 122, 131, 138], shared-access data repositories [7, 97, 154] and social media networks [3, 99]. Questions of privacy have also been raised in relation to interactions taking place in public space, as in the case of interactive installations [124, 172]. Many papers also discuss concerns around persuasion and deception in connection to services that aim at increasing profit margins by manipulating end-user's actions [30, 40, 66, 67]. In addition, emotional manipulation is frequently discussed in papers concerning autonomous agents such as

End-Users	Instances	References
Children and teenagers	14	in general [24, 42, 43, 55, 59, 88, 90, 99, 109, 121, 163, 165, 167, 173]
Workers	10	Amazon Mechanical Turk workers [10, 82, 83, 87, 103], musicians [53, 152], Uber drivers [100] and home health aides [162], shipping industry [179].
Patients/with health conditions	9	neurological illnesses [13, 35, 57, 76], mental health diagnosis [128, 135, 146], substance addiction [28], cancer [173]
Minorities	5	gender and sexual [150], people with specific communication [94, 176] and learning needs [16, 143]
Women	4	pregnant [12], with impaired hearing [176], in general [58, 153]
Older adults	4	[1, 26, 57, 76, 95, 174]
Rural populations	3	in Namibia [126], South Africa [19] and Bangladesh [153]
Non-human	1	birds [89]

Table 3: End-users that have raised design questions and considerations of ethics.

social robots [79, 84, 92, 95, 133, 134] and chatbots [140]. More rarely, ill-intended persuasion is connected with data visualisations [32] and potentially unethical practices of nudging behaviour [25].

When it comes to broader societal issues, concerns around injustice, unfairness, exclusion, and bias feature most often relating to AI [49, 101, 150, 161, 168, 171, 179]. Questions of justice are also often raised in studies involving temporary workers (for example, Amazon Mechanical Turk workers) [10, 82, 87, 100, 103, 162]. Ethnographic studies involving rural and indigenous populations also tend to focus on related topics, including the digital divide, power asymmetries and digital imperialism [72, 83, 126, 153]. Issues of social stigma and discrimination are similarly often raised in studies involving individuals with mental illnesses [128, 135, 146] and sexual minorities [150].

3.4 Approaching Ethics in Design Research

The second research question relates to how ethical considerations have been approached, explored and engaged with across the sample. Most papers report empirical studies devised to raise and address ethical issues, often employing user research methods to consult stakeholders directly, although at times also employing design methods without stakeholders' presence such as tools for team discussion. In addition to (or instead of) such empirical explorations, other papers employ philosophical and theoretical frameworks to inform and support their understanding of ethics. And how these diverse approaches to ethics are used across the sample is what we describe next.

3.4.1 Empirical Approaches. Many papers in the sample report on empirical studies conducted to surface ethical considerations (See Table 4). These studies frequently employ user research methods well-known to the HCI community (interviews, questionnaires, focus groups, observations, and co-design workshops), conducted both in the lab and in the field. Participants in these empirical studies include previous or current end-users [3, 7, 10, 53, 82, 87, 105, 109, 113, 138], potential or future end-users [13, 19, 24, 26, 35, 57, 59, 68, 78, 84, 90, 94, 95, 99, 120, 121, 123, 126, 128, 130, 133, 134, 136, 143, 145, 146, 152, 153, 156, 162–164, 167, 171, 173, 174, 176, 178], close contacts to end-users [163, 173], technology creators and researchers [2, 9, 29–31, 65, 101, 112, 114, 131, 135, 147, 168, 170, 179], and multiple stakeholders at once [21, 34, 47, 154]. A small number of papers report on experiments and surveys conducted not with end-users but with paid, crowd-sourced participant samples (for example, Amazon Mechanical Turk) [84, 102, 133, 140, 161].

The majority of papers report findings from participatory and co-design workshops, followed closely by field and interview studies which are also featured frequently (See Table 4). A small number of field studies additionally propose 'activist systems' designed to elevate real-world ethical concerns while striving to realise change. In particular, this sample features examples of a platform for citizen-led governance experiments [105], an immersive theatrical installation designed to raise ethical awareness among the audience [144] and systems targeting fairer conditions for workers crowd-sourced via marketplaces such as Amazon's Mechanical Turk [10, 82, 87]. In contrast, labs and online experiments are less frequently reported, and this sample features a small number of surveys (online questionnaires).

Distinct from empirical approaches entailing the direct involvement of stakeholders and users to various degrees, some papers promote the use of 'expert-only methods'. Empathy-building tools, personas, stakeholder matrices and card-based materials have all been used to facilitate self-reflection and collaboration between teams and students [9, 18, 42, 55, 101, 135, 139, 179]. Critical appraisals of design features and speculative scenarios have also been reported [5, 31, 35, 40, 43, 49, 50, 58, 67, 79, 92, 108, 119, 122, 123, 125, 146, 150, 159]. This sample also features content analyses of online forum discussions [54, 66, 100, 103] and presentations of manifestos [63], but these are rare.

Across the sample and diverse methodologies reported, speculation has often been used as a material or stimulus for surfacing, extrapolating from, and raising awareness of how technologies can imbue, even invisibly, with values, ideologies and behavioural norms.

In particular, speculation has been employed in critical conceptual designs [5, 50, 58, 122, 125, 150, 159, 177], participatory workshops [24, 90, 146, 162, 179] and user inquiry methods [161, 164], often in the form of fictional scenarios and provocative prototypes.

Lastly, several papers take stock of the literature and past projects to review and discuss ethical issues. This includes examples of argumentative essays [11, 16, 22, 44, 70, 75, 104, 110, 169], analyses of case studies, historical and contemporary examples [12, 15, 32, 77, 83, 91, 93, 97, 116] and literature reviews of specific subjects and technology domains [1, 25, 72, 88, 124, 132, 165]. Several of these papers define, propose and argue for theoretical orientations, as described in greater detail in the next section.

3.4.2 Theoretical Approaches. Although less frequently encountered than papers presenting empirical methods and findings, various articles within this sample also present theories, philosophies, and design orientations to structure discussions or lend more conceptual framings to empirical explorations. These 'theoretical approaches' include engagements with moral philosophy (for example, Utilitarian and Virtue Ethics), social and political philosophies (for example, Critical Theory and Social Justice), theories of design (for example, Value Sensitive Design) and social theories (for instance, Biopolitics). Papers engaging with theory make up approximately one-third of the sample in one form or another.

The framework most frequently employed across the sample was Value-Sensitive Design (VSD) [9, 29, 30, 35, 38, 42, 47, 50, 65, 67, 77, 88, 100], which can be considered a theory of design and a formative design framework [74]. The VSD approach seeks to account for 'human values' in a principled and systematic manner throughout the design process [62]. Following this approach, human values are conceptualised as an agreed-upon vocabulary defining what is important to each stakeholder group (security, transparency, accountability, among others). In our sample, studies employ VSD to identify and engage with human needs, elicit system requirements, and prioritise features in relation to conflicting stakeholder perspectives.

Another theoretical perspective well-represented in this sample is Critical Theory, often taking the form of Critical Design, Design Fictions and Speculative Design [11, 34, 50, 58, 122, 125, 144, 161, 179]. Critical theory is an approach to social philosophy that challenges assumptions and conceptions about power relations in society [11]. Critical Design brings this perspective to bear on the role product design plays in social and cultural spheres, often to foster debate and increase ethical awareness in place of an often-prioritised commercial focus [83]. Moral and technical imaginations are central to such a critical stance, which explains the frequent association of critical theory with design materialisations through speculative concepts and design fiction.

A perspective encountered less frequently across our sample is Care Ethics [77, 130, 139, 147], a philosophical outlook that shifts the moral focus towards embodied, situated and emergent relationships of mutual care [39], and as such a stark contrast to ethical philosophies centred on principles, norms and duties, such as deontology. When applied to design processes, care ethics, with its relational and responsive approach, foregrounds empathy and reciprocal commitments to each other as fundamental for decision-making [130, 139].

Meanwhile, utilitarian ethical frameworks are also found less frequently [102, 110, 120, 171]. Utilitarianism is a form of consequentialism which holds that an optimal ethical choice produces the greatest good for the greatest number of people by following a sort of 'moral arithmetic' to calculate the benefits of each outcome [20]. This philosophical perspective is most often encountered in this sample in the context of studies involving AI as a means to inform the programming of autonomous agents [102, 120, 171]. Another paper, however, notes the common criticism of consequentialism as unhelpful for decision making, given the difficulty (and perhaps impossibility) of weighing all positive and negative outcomes [110].

Other possible theoretical orientations appear even more rarely within this sample. A few papers explicitly engage with Social Justice theory [44, 72, 162], describing Social Justice-Oriented Interaction Design as a framework that can help designers commit to plurality, advocacy, and political considerations [44]. Similarly, Queer and Feminist theories twice appear regarding issues of inequality in the design of technology for minority groups [119, 150]. Virtue Ethics, which focuses on the cultivation of ethical wisdom through experience, appears in a single paper concerning mobile technology design to support mental health, resulting in a call for greater scrutiny of the subjective assumptions and hierarchies of expertise underlying design choices [12]. And Somatic Ethics is explored in a single paper depicting the experience of dancing with drones and positioning ethics as choreographing movements to be experienced somatically (through the body) [51].

Biopolitics is employed in a single instance as an analytical lens to drive reflection on issues of authority in biosensing designs [78]. Similarly, Foucault's theory of 'care of the self' is used to emphasise technology's epistemic dangers as a source of power [91]. And, Thanato-sensitive design is introduced, describing an approach to integrating the inevitability of mortality so that user-centred design can be more sensitive to those in bereavement and decrease harm in that sense [104]. Finally, amidst a predominant emphasis on Western-centric ethical frameworks across the sample, Confucian Ethics is the sole non-Western perspective featured in a single paper exploring individual roles as the source of moral obligations and character growth concerning the design of morally competent artificial agents [177]. Duty-based ethical frameworks (Kantian deontology) are not explicitly applied in any papers within this sample, although studies describing normative rules devised to guide actions could be interpreted as examples of this perspective, such as calls for 'categorised ethical guidelines' [108] and 'checklists' [90].

3.5 Recommendations for Ethical Action

Our final research question pertains to the compilation of practical recommendations for putting ethics into action. As described in section 2.7, the iterative and inductive analysis of the recommendations identified across the sample resulted in three conceptual groups. Papers across this corpus make frequent references to the process of ethical decision-making in terms of both the configuration of ethical participation in research and ethical interface design choices. And, cutting across both of these themes, many papers furthermore mention, discuss and problematise questions of responsibility, including which actors should take charge of ethical action during technology development. This section attends to each of these key

Methods	Instances	References
Workshops & Focus Groups	28	[2, 9, 13, 18, 24, 42, 55, 57, 59, 68, 90, 94, 95, 99, 101, 114, 121, 130, 135, 139, 143, 146, 162, 163, 167, 173, 176, 179]
Field Studies	25	[10, 19, 26, 30, 31, 34, 35, 57, 65, 78, 82, 87, 89, 99, 105, 113, 123, 126, 128, 134, 144, 152, 156, 174, 178]
Critical Prototypes & Expert Evaluations	20	[5, 31, 35, 40, 43, 49, 50, 58, 67, 79, 92, 108, 119, 122, 123, 125, 146, 150, 159, 177]
Interview Studies	19	[3, 7, 21, 29, 35, 47, 53, 76, 109, 112, 128, 131, 138, 147, 153, 154, 164, 168, 173]
Experiments	11	[8, 38, 84, 102, 107, 120, 133, 140, 143, 164, 171]
Argumentative Essays	11	[11, 16, 22, 44, 51, 70, 75, 104, 110, 169, 172]
Case Studies	9	[12, 15, 32, 77, 83, 91, 93, 97, 116]
Surveys	8	[7, 88, 109, 136, 138, 145, 161, 170]
Literature Reviews	7	[1, 25, 72, 88, 124, 132, 165]
Content Analysis	6	[28, 54, 63, 66, 100, 103]

Table 4: Papers which have used specific methods to identify, investigate and engage with ethical considerations.

formulations of ethical concern. In turn, Sections 3.5.1 and 3.5.2 provide an overview of specific recommendations in regards to putting ethics into practice within both research and interface design, respectively, and the third Section 3.5.3, speaking to ethical action as a direct reference to the role of the actors involved.

3.5.1 Ethics during Participation in Research. This sample offers several practical recommendations for the ethical involvement of people in design research. Some of these suggestions already comprise minimum research ethics standards in some, although not all jurisdictions [48]. Several papers provide recommendations concerning ethical procedures for obtaining informed consent from participants before data collection, advising that consent forms are written in accessible language [108, 143], participants granted enough time to become familiar with the technology before a study [174] and that consent should be revisited throughout a project [1, 22, 57, 75, 109, 121, 156, 170]. When it comes to making use of publicly available data for research purposes, studies advise reducing the risk of re-identification by reporting results at a low level of detail [1, 28, 108, 170], and if data is shared outside of initial agreements, to inform participants [21, 108]. In the case of public installations, others recommend allowing participants to withdraw at any time [15, 93, 172].

Many papers also advise researchers to prioritise the benefits of participation by, for example, acknowledging participants as co-creators [109] or authors [76], negotiating compensation in line with participants' preferences [77], gifting participants working prototypes [26, 57, 76, 130] or celebrating the conclusion of a project with an event [76]. Authors furthermore advise inviting participants to engage more directly in the configuration of research projects from the very start [13, 68, 77, 94, 105, 169]. Several papers also emphasise the need to identify means to foster, ethically, participant diversity and to become genuinely involved with the communities we study, by, for example, volunteering with organisations [16, 57, 76], yet without falling for the 'design saviour complex' which can ultimately worsen uneven power relations with end-users [83].

On a related note, several papers highlight that participating in and conducting research can prove an emotionally charged experience and propose appropriately preparing researchers to minimise possible sources of emotional discomfort to participants and promptly recognise signs of participant distress during the research [57, 75, 94, 104, 143]. Similarly, some papers promote support for researchers' well-being through counselling, group discussions, and a healthy work-life balance [57, 76, 112, 156]. Authors likewise advise incorporating domain experts and health professionals into teams researching sensitive contexts [59, 75, 104, 116]. A final and inclusive recommendation provided by authors in support of ethical HCI research is to articulate decisions made in support of well-being during published works as means of promoting awareness [57, 112].

3.5.2 Ethics within Interface Design Choices. Many papers across the sample frame design choices as means to address ethical concerns, even though they also acknowledge that it is challenging to make detailed recommendations, as each specific context requires an approach tailored to its characteristics. A large number argue that user autonomy can be increased through more transparent communication of both system intentions and technical limitations, for example [7, 15, 25, 26, 32, 54, 63, 72, 108, 125, 140]. Several also suggest that privacy concerns can be addressed through interface design by providing mechanisms for data control and the collection of less intrusive forms of data [7, 26, 32, 54, 113, 119, 122, 124, 128, 132, 154].

A large group of papers draw attention to the potential adverse consequences of technology on users' well-being. Authors, in turn, advise that designers avoid reinforcing trends toward the over-optimisation of behaviour [3, 25, 32, 78, 125, 128, 132] and consult experts if unfamiliar with how the particularities of a health domain can negatively impact users [13, 19, 47, 59, 89, 104, 132]. When it

comes to safety risks, authors advise the careful consideration of how to mitigate the possibility of physical hazards [107, 110].

Another, slightly smaller group of papers argue that design can and should serve as a means of accounting for and addressing social justice concerns by involving minorities in the design process and becoming more aware of the role designed products can play in perpetuating systems of oppression [44, 132, 150, 153, 161]. Other papers recommend and deploy 'activist systems' as means to tackle complex social challenges [10, 82]. Many, on the other hand, highlight that it is essential to recognise that concepts such as fairness are not easily translated into design features, and authors argue that the complex relationships between technologies and their surrounding socio-economic and political contexts can limit what could be possible to address by means of user interface design [101, 110, 168].

3.5.3 Ethics as Individual and Collective Responsibility. Most papers directly or indirectly encourage the individual design professionals to adopt measures against unethical practices by remaining mindful of intentions and reflecting upon the consequences of their choices [32, 50, 70, 75, 91, 93, 113]. Researchers within academic settings have likewise been advised to accept responsibility for ethical conduct beyond what is required and anticipated by institutional ethics procedures [116]. In contrast, however, a small group of papers warn that an individual's capacity to engage in ethical decision-making can be severely constrained by tensions with business goals or roles within enterprise hierarchies [31, 65]. For this reason, the authors recommend that more emphasis is placed on the creation of strategies to enhance individuals' capacity to act through tools and mediation processes [65].

Aligning with such a vision, education is often endorsed across the sample as a means of fostering ethical awareness among future generations of HCI and UX professionals [30–32, 65, 67]. Approaches recommended in this regard include the cultivation of an 'ethics of care' among students through the organisation of open-ended projects with small civic organisations [130], collaborative classroom critique of data collection and visualisation practices following first-hand experience [139], and the use of card-based tools to help students reflect on moral dilemmas and build new prototypes in response [18]. Across this subset of papers, authors frequently suggest that classroom activities should be designed to enhance students' awareness of the societal consequences of technology development. Their effectiveness can be observed by evidence of increased sensitivity to ethical issues on students' behalf.

Further emphasising the role of individuals as actors responsible for ethical decisions, a small number of papers also suggest raising end-users' awareness of the risks and social consequences entailed in technology adoption [40]. Attempts to educate the public have been realised in creative ways, including an immersive theatre experience designed to engage the public in discussions concerning personal data misuse by third parties [144], a provocative demo employing a bio-metric mirror to entice reactions from passersby [178], and the invitation of school students to discuss the values embedded in a well-known video streaming platform [42]. These papers suggest that strategies devised to invite end-users to reflect on ethical concerns should strive to prove appealing and, if deemed suitable, also provocative to capture end-users' attention and leave behind an impactful, take-home message.

Relatively fewer papers, in contrast, directly invoke responsibility from the higher ranks of organisations or the public sector by calling, for example, for more robust regulation as means to shape future technological developments or suggesting concrete policy implications [2, 3, 114, 140, 145]. A few papers do criticise current regulations for failing to attend to ethical issues, arguing that overarching rules are hard to apply if not customised to particular contexts [55, 101]. A single exception praises policies derived from the Responsible Research and Innovation (RRI) agenda [70]. Even though very few papers actively advocate for and discuss ways to increase institutional and national responsibilities beyond the individual, this sample also does not explicitly suggest that higher-level entities are exempt from their share of responsibility.

4 DISCUSSION

This review was motivated by the increasingly urgent need to support academics, practitioners and professionals working with technology design and user research. By assimilating the knowledge of just how to put ethics 'into practice', results show a plurality of ways of approaching and relating to the topic. This review thus demonstrates the potential for an ethical stance to crystallise responsible design and research beyond the usual metrics of system adoption, engagement and usability. This final section revisits the research questions, reflects on the review's findings and discusses how they relate to literature beyond and contained within this sample (for clarity, when results are positioned in relation to references external to the review corpus, these are indicated in the text). Such reflections aim at illuminating future directions for HCI to commit to ethics more meaningfully by strengthening explorations of ethical requirements and creating more harmonic structures for exercising responsibility.

4.1 Establishing Priorities and Commitments

Our first research question sought to identify which ethical concerns have been the focus of SIGCHI research. Results made evident that the topic of ethics can encompass issues concerning not only the most personal, intimate aspects of human experiences but also the relational, collective and political structures surrounding it. This observation is well-aligned with findings from the previous review of ethics in Computer Science journals referenced in the introduction to this work [148]. The increased reference to societal challenges as pertinent to design and research ethics is likewise much in agreement with the contemporary literature concerning the politics of digital artefacts [36], design justice [33] and data feminism [41]. This observation emphasises the importance of critically positioning technological artefacts as complexly embedded in historical, cultural and economic spheres - a statement also made by others within the broader HCI community and beyond this review sample [17]. Therefore, the application of ethics in practice requires contemplation concerning how the processes of creating and using digital systems can have consequences for individuals, groups, and public affairs alike.

The first research question also inquired which technology types have proved the focus of publications about ethics at SIGCHI –

findings revealing the prevalence of discussions of applications for artificial intelligence (AI). Indeed, the capacity of AI to reach conclusions, persuade and influence real-life outcomes makes these systems particularly prone to generating moral dilemmas. The definition of ethical requirements for the AI domain is rendered additionally complex by the general lack of transparency regarding algorithms and performance metrics, which means that strategies to improve AI ethics demand much more than technical work, as seen in Section 3.5.2. The debate about AI ethics extends beyond this sample and HCI, as researchers question how much power digital systems should have over civic life and if negative consequences can ever be avoided [52]. Such reflections only reinforce that critical thinking within this domain is essential to informing the definition and placement of ethical boundaries for autonomous systems, as the sample makes clear that 'automation' is not always beneficial, especially when it is not well-understood. As an implication for design and research practice, we suggest the need first to evaluate the actual gain obtained by delegating decision-making power to potentially unfair and unpredictable machines and devise precise and actionable strategies to reduce possible harms before their deployment.

The review has also found that papers focus less frequently on specific end-user groups than on technology types. We speculate that articles are more likely to focus on technology types than on end-user groups due to the frequent focus of HCI on system building, and it is from this perspective, that ethical issues concerning different user groups are debated. However, a risk of adopting this approach lies in neglecting critical reflections pertaining to specific populations should technology be deemed equally experienced, used and adopted by all individuals – which is most probably never the case. While maintaining a gaze on the technical components of ethical design is crucial, we argue that mindfully understanding differences between user groups is also very much necessary.

Furthermore, we have examined the groups of people involved in the participatory studies, revealing a surprising gap. Despite demonstrating concern for issues of justice and fairness, the revised papers seldom feature the direct participation of social and ethnic minorities; much of the sample instead studies children, patients, and older adults. Even though such a gap might not reflect the HCI literature more broadly, this result shows that user research does not always succeed in seeking to actively engage with people that can be harder to reach or who demand a more careful participant engagement approach. We take this observation as an opportunity to urge researchers and designers to elevate diversity and inclusion as a priority of their agendas. Without the ethical involvement of those considered members of 'marginalised populations', design and research will fail to attend to the particularities of groups already misunderstood, misrepresented and expressing cultural differences, as discussed by the broader HCI community [155]. Therefore, despite obstacles to devising and conducting user research with particular groups (see Section 3.5.1), there is a need to put more effort into such endeavours so that system design does not further existing stigmas and instead helps surface and attend to the vast plurality of human needs and vulnerabilities.

Such gathering of ethical matters at SIGCHI makes evident that technology design should account for users' vulnerabilities and intersections, just as much as it already accounts for the craft of 'appealing' interfaces. Ethical concerns surfaced by the sample illustrate the capacity of technologies of all sorts to disrespect human needs for autonomy, happiness and dignity – in clear contrast with visions of HCI as motivated by the idea of 'sustaining human flourishing'. Ethics is a growing trend at SIGCHI, yet for ethics to become more accepted as a measure of success, we, designers and researchers, might need to reconsider standard assumptions of what 'good' technology design means. The broad range of ethical concerns, technology types and groups identified as subject matters for ethical consideration only confirms that the goal of creating 'useful tools for productive work' and 'delightful experiences' should not trap user-centred design in a narrow definition of scope that potentially devalues the importance of ethics, as argued by argumentative works further beyond this review [45].

4.2 Adding Structure to Ethical Deliberation

The second research question led to the investigation of exactly how ethical considerations have been approached, both theoretically and empirically, at SIGCHI. Our analysis indicates that it is possible to put ethics into practice by adopting methods well-known by the HCI community. For instance, user studies are often used across this sample to critically assess the potential negative impact of technologies, often through qualitative methods to understand subjective, contextual and intricate experiences. Quantitative methods, including surveys and lab experiments, also have their place, providing a somewhat more objective argument for the prevalence of ethical issues. Other approaches have skirted the direct involvement of end-users by yielding tools to facilitate team discussion and proving their value as approaches to conduct a critical appraisal of empirical and secondary data sources to support more informed decisions. These procedures, in principle, do not differ substantially from their traditional employment in Interaction Design [127], and the familiarity of designers and researchers with them might prove to be an advantage for their adoption.

Although there exist examples of papers identifying ethical issues as by-products of their work (for example, [2]), studies contained within this sample typically engage in research and design processes with the mindset that ethical concerns are in and of themselves primary study objects. This observation constitutes an essential point for individuals seeking to make ethics a more integral aspect of their work: ethics is best enacted if considered a core component of the complete research design process, and a guiding viewpoint, from the very beginning. The vast spectrum of empirical approaches identified in this sample provides, collectively, a portfolio of various enablers of reflexivity - diverse methods for adoption at stages throughout the design life-cycle - in contrast with a more transitory, checkbox approach, criticised as detrimental for ethical action by the sample [101].

In addition to highlighting the possible adoption of well-established user research methods, findings also demonstrate the significance of the so-called 'speculative approaches' [46] to envisioning preferable futures and safely surfacing unethical outcomes. Papers contained within the sample often connect speculation to critical design to foreground the intentions of technology creators, illuminate potentially hidden ideologies, and propose under-explored design visions. Beyond speculating about the future,

when it comes to concrete recommendations for action another possibility identified in the sample include interventions 'in-the-wild' (for example, [82]). Field studies deploying activities and systems designed to drive change in the real world are a valuable source of inspiration for a type of activism that HCI could strive for.

This review surfaces examples of theories, philosophies, and design orientations argued as proper structures for directing engagement with ethics. Different views, of course, conceptualise ethics in considerably different ways. Rather than arguing which yields the definitive perspective on complex moral challenges, learning from this pluralism of perspectives is most likely the most fruitful approach, permitting the deliberation of diverse positions without necessarily falling into a complete relativism. A utilitarian stance, for instance, takes consequences as the dominant aspect to be discussed concerning autonomous agents (for example, [120]). Yet, it has been argued that there is value in considering alternative theories to confront automation dilemmas and search for their causes, not only the possible outcomes.

Regarding such theoretical pluralism, this review also reveals a critical gap previously highlighted as a significant bias in HCI's engagement with ethics by previous research beyond this sample [182]. The vast majority of the sample references 'Western-centric' literature, theories, and philosophical orientations indicating the lack of theoretical diversity across the sample, also remarked by past AI-ethics reviews [157]. This finding backs up the suggestion that future work should strive to learn more from other worldviews (for example, collectivism [177]) as a way to expand theoretical possibilities.

Review findings also provide sufficient grounds to argue that it is crucial to continue expanding theoretical knowledge to support the specific ethical challenges of technology design and research. The theoretical and methodological framework most frequently employed across this SIGCHI sample is Value-Sensitive Design, possibly a consequence of its origins in HCI [61]. However, a few papers also introduce theories from other fields, such as Biopolitics [78], which demonstrate how direct engagement with theoretical foundations is advantageous for ethics in practice. Therefore, these findings show that developing novel theories with HCI roots and building stronger interdisciplinary connections with other fields (for example, social sciences, philosophy, and gender studies) can be highly beneficial to supporting ethical reasoning applied to digital technologies.

Despite the presence of such references, most of the sample does little to engage with theory actively (See Section 3.4.2), a gap also reported in a previous review of ethics in Computer Science more broadly [148]. While our scope is too narrow to draw conclusions about the field of HCI as a whole, when discussions of ethics are carried out without formal definitions and rely only on an 'intuitive' understanding of the everyday use of the term, an opportunity is missed to gain value from and add to established sources of knowledge that could function as reference points for more robust analyses. Rather than making ethics a rigid, static and formalised concept, a theoretical foundation can be game-changing for more robust argumentation and decision-making.

4.3 Harmonising Roles and Responsibilities

This review has gathered a considerable collection of recommendations for putting ethics into practice (See Section 3.5). A common thread across most references is that as each research configuration and design context will present its particular challenges, thus professionals are advised to keep a sustained engagement with ethics, adopting a so-called 'situational' [116] and 'responsive' stance [76]. Instead of providing definitive answers to complex dilemmas, papers in the sample invite researchers and designers to continuously deliberate on appropriate courses of action as unforeseen situations emerge.

Although there are valid arguments for advocating for individual responsibility, such an expectation might clash with the constraints, demands and formalities of the contexts in which professionals are situated. As a few articles in the sample argue, when leaders, workplaces and the innovation culture do not support ethical thinking, technology creators do not have the autonomy to act more ethically [66]. Therefore, despite the original intention of this review to better equip individuals to apply ethics to their work, a handful of papers in the sample [105, 130] have brought to our attention that limitations on individuals' capacity to act combined with the complexity entailed in ethical decision-making are still significant challenges.

A possible way forward could be to establish more robust and evidence-based policies and redistribute responsibility across other entities. Research in new media studies, for instance, strongly advocates in favour of recasting national and international regulatory agencies as well as consumer and non-governmental organisations to become core agents in securing end-users' best interests [73]. Surprisingly, however, this review sample usually does not emphasise the need for stronger regulations, external evaluation, and legal accountability as means to protect users and guide individual action. In fact, institutional ethics committees - which outline standard procedures for research - are most often criticised for providing little support when ethical issues do arise (for example, [14]).

This unresolved tension has important implications, especially concerning how responsibility structures might ever be optimally consolidated so that ethical decisions happen in reality. An overarching ethical framework harmonising institutional, collective and individual roles could perhaps provide more sustainable pathways. In the meantime, we argue that it is still paramount to find ways now to protect end-users from harm by trying to empower technology creators to work towards system designs attuned to fairer futures. Our suggestions include cultivating communities of practice that encourage critical thinking; proposing tools and processes to facilitate ethics mediation between teams, organisations, and ultimately end-users; providing channels for professionals to more transparently express the contingencies of ethical decision-making (for instance, as part of publication templates); and initiating discussions about ethics within and beyond the SIGCHI-community. Caring leadership and collaboration will be required to pursue and promote such an ethical HCI agenda in the following years.

4.4 In Summary

This scoping review highlights diverse ways of thinking about, approaching and relating to the topic of 'ethics'. It is our hope that

capturing and organising these references in the form of this structured overview represents a valuable resource for those who share the goal of applying ethics more actively in design and research practice. Based on the gathered body of work and our reflections, we devise the following broad summary of implications to support the reader in making sense of the broad scope of this corpus:

- The complete process of digital innovation, from technology creation to its adoption, can negatively and unfairly impact personal and societal spheres of human life; such a comprehensive understanding of the full spectrum of when, where and how harm can take place (and who harms and is harmed) is the foundation of ethical action.
- An informed engagement with theories, especially from disciplines with a long tradition in conceptualising ethics, is essential for robust argumentation; however, instead of discussing which framework offers definitive answers, theory can help capture divergent viewpoints and bring to light the complexity of ethical deliberation.
- Building more ethical systems can start by integrating ethical lenses into commonplace user-centred design approaches; in addition to that, speculation is well-suited to help surface hidden issues and communicate alternative futures; design activism can complete this cycle as a much-needed catalyst to materialise change.
- Without harmony across the roles of leaders, organisations, universities, governments and regulatory entities, it is challenging for individual professionals to pursue a broad ethical design agenda; beyond knowledge and tools, technology creators need supportive environments and more sustainable structures of responsibility attribution.

4.5 Limitations and Reflections

Despite being motivated by the desire to produce a manageable body of knowledge that would also be sufficient to start answering questions that demand a systematic investigation, this review has limitations. We have deliberately avoided over-generalising findings throughout the text as our contribution is limited to the pre-defined goals and scope. We here reflect and comment on the methodological choices made to acknowledge and discuss the boundaries of our research scope, especially when compared to the vast field of HCI.

Our review focuses only on SIGCHI-sponsored conferences, which means that findings reflect only this specific segment of the broader HCI literature. We justify our choice first by emphasising that our goal was not to provide a definitive account of ethical discourse in HCI but gather a sample of approaches and possible pathways for understanding and applying ethics to technology design research. Future systematic reviews could encompass other HCI venues and different literature sources to add to, and perhaps critically contrast with, the insights extracted through this review of SIGCHI.

Another limitation is that this review includes only archival peer-reviewed full papers. This approach has allowed for a more cohesive analysis by ensuring that each paper included in the sample had a similar structure and underwent a similar submission and acceptance process. However, this choice meant that insights from maturing sources of knowledge such as late-breaking works and workshops were not contemplated. For this reason, we emphasise here that any gaps and trends identified in our sample cannot be interpreted as gaps in SIGCHI papers. Future works could consider reviewing these other papers to understand better how ethics discussions are distributed across specific publication types.

The review is also limited by the search strategy focused on title, abstract or keywords. This decision was made for pragmatic reasons to avoid including a large number of papers irrelevant to the research question, such as those that mention only "approval by an ethics committee". However, this choice meant that those papers that happened to not mention the word 'ethics' in these query fields were not identified in our search. Future research conducting a quantitative analysis of how many papers without ethics in their title, abstract and keywords extensively engage with the topic could lead to an insightful discovery.

Finally, a difficult choice in the design of this review strategy concerned whether to include other keywords related to ethics, such as 'justice', 'values' or 'rights' in the search query. Upon careful consideration and discussion, we concluded that any particular set of terms about ethics is at risk of failing to prove exhaustive. We also could not devise unbiased objective criteria to justify the inclusion of specific terms over others, and we deemed it inappropriate to claim a paper is 'about ethics' if the authors chose not to use the keyword themselves. We encourage future works to build upon this work and expand the search criteria to gather even more sources of knowledge to guide ethical practice and better characterise the ethics-related landscape in the diverse discipline of HCI.

5 CONCLUSION

Intending to gain a deeper understanding of how a fundamental philosophical concept applies to the diverse field of HCI, this paper contributes a rigorous scoping review of 'ethics' as approached by the SIGCHI literature. Findings highlight a growing interest in the topic in recent years, a trend that only reinforces the importance of ethics for technology design and research. We commend the pervasive and consistent consideration of ethics evident across this sample. At the same time, we aspire that this work intensifies critical engagement with ethics across the broader HCI community. As SIGCHI-sponsored conferences are prominent venues guiding HCI research worldwide, the sources of evidence examined in this paper pave the way for future ethical engagements. This sample offers a vast collection of recommendations to engage with the often elusive concept of ethics, which in aggregate can serve as a valuable resource for a diverse audience, from early-stage researchers to seasoned academics and institutional leaders.

This review reveals diverse possible paths for recognising and preventing ethical concerns while allowing more robust debates and well-informed argumentation. Similarly, the diverse catalogue of identified methods brings about a vision for ethically-centred design processes in which critical thinking connects user inquiries to design explorations. The opportunity now arises to adopt and develop theoretical and methodological perspectives that support such an applied and reflexive type of ethics. As means to transform insight into positive real-life change, beyond method and theory, it is also essential to consider novel approaches to increase the

harmony between individual, collective and institutional responsibilities. Every unique configuration of context, technology and users has its particular requirements and challenges, but ethical thinking often converges on topics of human autonomy, beneficence, welfare and justice. Understanding broader socio-political contexts are just as important as engaging with individual particularities so that ethics can protect those who might be at risk and establish fairer relationships of power.

As a final reflection, some may wonder why we, as researchers, part of the SIGCHI community, should dare to care about ethics in the first place. It can be challenging to cultivate ethical awareness within and across individuals in a knowledge field historically driven by fast and bold technical innovation. Committing to ethical thinking means leaving behind a position of indifference for a path rarely permissive of definitive answers. However, we may find motivation and inspiration in recognising that this is perhaps the only means of pursuing and achieving the human flourishing for which HCI has striven all along. Inhabiting privileged positions as producers and propagators of knowledge, we have a shared responsibility to shape our actions mindfully so that they serve not only our own goals and desires but the common good, in solidarity with the aspirations and needs of those who comprise our surroundings and, indeed, the planet.

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