Leveraging Personas for Social Impact: A Review of Their Applications to Social Good in Design

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Personas inform design by representing diverse user needs. Since their initial application in commercial technology contexts, personas have been adopted in several research domains for public good, such as health, accessibility, politics and civic society, education, sustainability, cybersecurity, and understanding deviant behavior. In this review paper, we analyzed 58 research studies that created personas in these domains, referred to as Personas for Social Good (PFSG). In most of the studies, PFSG was primarily exploratory and focused on initial methodology development. More than half (59%) neglected to discuss concerns with stereotyping or evaluate how personas contributed to improving social concerns in their respective domains. To facilitate a shift towards more socially conscious persona applications, we identified and critically examined the most comprehensive PFSG domain applications in our sample. Based on their strengths, we present an ecological framework to guide researchers in holistically aligning persona creation efforts with addressing critical social challenges.

Keywords: Personas, use cases, social good

1 INTRODUCTION

Personas are imaginary individuals that portray real user groups [1]. Widely adopted in human-computer interaction (HCI) and related fields, personas richly represent user preferences with contextual details of lived experiences, going beyond reductive characterizations [21] to provide "shared mental models" [7] for stakeholder communication. Specifically, personas depict how hypothetical users may perceive the usability of technologies and/or services, which facilitates richer understanding of target user goals and characteristics. This also enables designers to better empathize with user needs and, in turn, design more relevant and fulfilling user experiences [33].

First introduced in software development and engineering of commercial products [13], personas have since been adopted in fields beyond commercial enterprise, such as healthcare and policy [20]. An emerging body of literature also highlights the potential of personas for design use cases that benefit society [20,54,65]. Nevertheless, beyond broad generalizations about the merits of personas for design thinking, the distinct application of personas to socially impactful design of products and services remains unclear. Reliable standards for persona usage – particularly in non-industrial sectors concerned with social impact and public good – are lacking. Crucial questions remain unanswered, such as: *How can personas contribute specifically to designs for social good? What makes personas useful in these social impact settings? What conditions do persona research projects require to ensure relevant social impact application?*

A comprehensive and systematic framework for how stakeholders can use personas in these settings is challenging to develop, in part due to the large spectrum of sectors that utilize personas. However, such investigation is both important and necessary to expand the relevance of personas and HCI at large. HCI encompasses the interaction between people and technology, yet the scope of the field extends far beyond the study of user interfaces [27]. HCI researchers can contribute meaningful solutions to societal challenges by focusing on larger psychological, political, and sociocultural implications of technological design. These observations further parallel advocacy within the persona and wider HCI research community to humanize end-users beyond stereotypes and as individuals with subjective narratives and intersectional identities [34,50,56,63], rather than mere members of commercial user groups. Similarly, there has been a growing desire for societal engagement within the HCI community, including the use of design methods to contribute to United Nations (UN) sustainability targets – referred to as sustainable HCI (sHCI) [6,23].

Driven by this research gap, the present research aims to offer an overview of how personas have been adopted in domains related to social good – henceforth referred to as *personas for social good* (PFSG). While previous design research

has highlighted isolated cases of PFSG, to the best of our knowledge, no work has synthesized and reviewed the distinct application of PFSG. The initiation of a standardized framework for PFSG is a primary driving force behind the present work. Accordingly, it is important to first establish what *social good* refers to in these contexts. By 'social good,' we mean *motives not driven by commercial purposes*, such as maximizing revenue or profit (or other metrics that indirectly target such goals). Instead, the primary motives of PFSG are aimed at solutions improving individual and community well-being, and other challenging social dilemmas that design solutions can (at least partially) address [54]. PFSG require specific modifications from personas' typical HCI usage, most notably the inclusion of narrative information framed with social good in mind – such as the personas' political views, social attitudes, and their engagement with their psychosocial communities – as well as their expanded application to socially beneficial designs rather than commercial objectives [22]. To emphasize this distinction, we define PFSG as *human-centered design contributing to services or products that promote human well-being on a broad scale*.

Importantly, this motivation for socially driven personas necessitates a comprehensive evaluation of how different social good objectives can be specifically fulfilled using personas. Moreover, as elucidated in Ladik and Stewart's "contribution continuum" [38:157], different studies contribute new ideas via a diversity of empirical mechanisms, including but not limited to testing exploratory hypotheses, validating existing methodologies, and providing guidelines for future research. Thus, there is a substantial fragmentation of research goals, contributions, and empirical methods to social good domains, necessitating a further synthesis. Filling this gap is essential, as it can enable researchers adopting PFSG to situate their work more effectively within the extant body of literature. Furthermore, it can facilitate identifying opportunities for both field-specific (i.e., within HCI) and interdisciplinary collaboration. To this end, we pose the first research question (RQ):

RQ1: *What are the research contexts and contributions of personas for social good?*

Several researchers have also elucidated the challenges of personas to adequately represent target users and which may inadvertently perpetuate stereotypes whilst isolating designers and stakeholders from user needs [18,39,64]. Stereotypical user representations harm both design – wherein designers unintentionally stereotype users based on their own beliefs and goals – and ultimate usage – namely, a lack of design accessibility and relevance with regard to end-user characteristics. An emerging body of work has sought to acknowledge and mitigate these challenges through participatory design processes, which integrate and emphasize feedback from representative end-users in the persona construction processes [15,25,65]. Such approaches may not only alleviate but also have the potential to transcend problematic stereotyping in personas, which also concerns PFSG. We, therefore, pose the additional question:

RQ2: *How is stereotyping accounted for in studies applying personas to social good?*

Another key question is how PFSG contributions can directly serve their target user groups and realize positive impact on society. Without such an assessment, there is an insufficient rationale for deploying time- (and in many cases, cost-) intensive resources to creating PFSG — other than the academic interests of the authors — and there is little perceived value in the persona creations for the targeted end-users. This further perpetuates the oft-extractive nature of research, wherein the real-life challenges of the study participants and/or populations of interest serve to only provide material for research but see little alleviation for the subjects themselves. As such, we pose the following RQ:

RQ3: *How is the impact to target users considered in studies applying personas to social good?*

To address these three RQs, this review (1) collects, analyzes, and aggregates studies using personas in different domains characterized as 'social good' motives, (2) summarizes the novel contributions of PFSG, including the research objectives motivating persona usage during their design processes, (3) assesses how PFSG are evaluated to prevent

stereotyping and enhance social impact, and ultimately (4) makes recommendations for future practice and study. Beyond contributing to the literature on HCI and social impact (e.g., [5,27,28,49]), our findings highlight how:

- Personas have been adopted in research in several social good domains, namely health, accessibility, politics and civic society, education, sustainability, cybersecurity, and understanding deviant behavior in society.
- Persona creation in social good domains continues to be primarily exploratory and focused on methodological development.
- More than half of the studies reviewed did not explicitly assess stereotyping concerns or evaluate the real impact of personas for addressing challenges in the social good domain.

We further propose an ecological framework for researchers creating PFSG. The aim of this framework is to better align persona creation with target population challenges and larger social impact frameworks, such as the *United Nations Sustainable Development Goals* (UN SDGs). In addition, we provide a critical appraisal checklist to guide researchers in evaluating their PFSG research.

2 RELATED WORKS

Several reviews of the general literature on personas exist, but most are limited by a lack of systematic data collection and none, to our knowledge, specifically address PFSG. Moreover, while a number of studies specify the application of personas in design, these studies frequently employ a case study approach with limited generalization [66]. Salminen et al. [53] reviewed the research on quantitative persona creation (2005–2019) and highlighted the need for sharing research resources such as program code and evaluation metrics to foster an inclusive community of persona implementers. Another study by Guan et al. [22] identified diverse efforts to incorporate details related to lifestyle and the cultural contexts of product usage in personas adopted in different commercial contexts. While these articles provide key insights for future persona research and practice, they mainly focus on characterizing the state of persona research in industry and neglect how personas may be used in social good use cases. Therefore, there is a scarcity of work on PFSG specifically. While Salminen et al. [54] listed PFSG as a major point for future work (SDGs), this review did not explicitly consider PFSG, and PFSG-specific applications were limited to its discussion section.

Numerous articles have discussed the advantages and disadvantages of personas (e.g., [31,46,51]), which include fears about stereotyping and the misrepresentation of end users [39,64]. Chapman and Milham [11] contend that personas may be neither informative nor representative for sharing information about users, as they distill complex characteristics of user populations, and are often not verified with real users, thereby making it challenging to infer specific use cases from persona characteristics. Marsden and Haag's study [40] of persona construction processes concluded that expert designers did not recognize "the responsibility to actively take ownership of the impressions that the personas generated" (p. 4026). These findings relate primarily to the commercial settings and objectives for which personas have been most frequently applied. Indeed, few prior studies outline how personas have been implemented differently in non-commercial as opposed to commercial settings. This hampers the applicability of personas to the facilitation of personas' *value in use* for diverse and underrepresented communities [45,68]. Indeed, Rönkkö et al. [52] highlighted that concerns about competition and market positioning often overshadow the impact of personas for users.

Thus, design driven by PFSG has significant room for growth in developing solutions for a diverse range of societal challenges. Research on PFSG (and personas in general) necessitates a higher level of inclusivity to pivot from a predominantly commercial role to a more socially significant contribution. Whilst an emerging body of work has adopted participatory design processes to transcend reductive personas and directly reflect user input in persona co-creation

[15,25,65], a systematic analysis of non-commercial personas research is necessary to integrate valuable lessons from previous work, and more importantly to consolidate findings on PFSG specifically [14]. A productive dialogue between HCI and other domains is crucial to accomplish this. This discussion is particularly pertinent for PFSG in diverse domains, which are differentiated from user-centered design (UCD) and participatory tools primarily adopted to facilitate commercial usability (e.g., technical product testing). A detailed exploration of personas used for socially beneficial design is therefore necessary to demonstrate the compatibility of personas (and HCI in general) to fields concerned with social impact.

3 METHODOLOGY

This review expands upon the findings of a prior review by Salminen et al. [54] on persona and design use cases. Following the methodology of a previous literature review [54], our method consisted of (1) identifying key research articles for addressing the RQs, (2) inferring title, abstract, and carrying out full-text screening to include/exclude relevant articles, and (3) final inclusion and analysis. Three databases were accessed for data extraction based on their scope (i.e., Google Scholar) and relevance to HCI, personas, and design (i.e., ACM Digital Library (DL) and IEEE Explore). As a secondary objective of the prior review, key contributions of PFSG (or lack thereof) in the dataset were coded in a standardized data extraction form [61]. Here, we identified 31 studies (out of 95) that leveraged PFSG, as opposed to commercial purposes. These 31 studies were motivated to make a positive impact on society at large such as improving health outcomes, as opposed to, for example, bringing a new commercial product to market.

Next, given that the analysis from the systematic review by Salminen et al. only covered studies until mid-2021, we further expanded the initial dataset by reviewing each new research article added to Google Scholar's index from mid-2021 to mid-2022 that mentioned "personas" in the title (intitle:"personas"), and then manually screened the relevance of each article to determine a design for social good. Articles that met this inclusion criterion were included as new articles in our analysis. Moreover, we expanded the categories for social good from the original review, as our additional search identified new social good areas in which personas had been applied. Overall, 27 new articles were identified in this stage, amounting to 58 articles in the final analysis. For all 58 articles, key contributions of the PFSG were then coded in a new standardized data extraction form [61] for the present analysis (Table 1).

Table 1: Data categories for information extracted from the articles.

Category	Description	RQ Addressed
Basic information	Title, year, keywords	N/A
Domain of social good application	Context under which design activities took place and were ultimately used for, e.g., healthcare, civic engagement. Context must be related to social good.	RQ1
Research goal	Research goals guiding the deployment of PFSG; e.g., exploratory study, validation study, literature review.	RQ1
Novel contribution	New perspectives introduced by authors in the application of PFSG; e.g., new methods, guidelines.	RQ1
Stereotypes consideration	How authors explicitly refer to and address issues with stereotypes in personas.	RQ2
Social impact consideration	How studies assessed the level of positive social impact of persona deployment on addressing the pre-identified user challenges.	RQ3

4 FINDINGS

4.1 RQ1: Overview of Social Good Domains: Goals and Contributions

Table 2 highlights the seven social good domain categories identified in the current dataset *a posteriori*: health, accessibility, politics and civic society, education, sustainability, cybersecurity, and understanding deviant behavior. These categories were identified by reading the articles and interpreting the social good use cases described.

Table 2: Use cases of persona for social good.

Social good domain	Purpose	Definition	N
Health	Improve delivery of healthcare services	Aid public, private, and non-profit organizations that help a jurisdiction deliver important healthcare services.	28
Accessibility	Increase accessibility (physical and social)	Enhance, increase and expand the quality, value, or scope of activities for more people to take advantage of and use.	10
Politics	Enhance civic participation	Facilitate activities carried out by an individual or group to address issues of public importance in society.	6
Education	Optimize pedagogical quality	Expand access to learning and raise standards of learning experiences by ensuring individuals have equitable access to different levels of education and vocational training.	6
Sustainability	Promote ecologically sustainable practices	Development that integrates social, economic, and environmental aims to mutually strengthen each other and satisfy current societal demands, while optimizing the capacity for future generations to meet their own needs.	4
Cybersecurity	Mitigate digital vulnerabilities	Maintain protection from ransomware and other forms of hacker attacks	2
Understanding deviant behavior	Minimize the harmful implications of disruptive behavior	Promote awareness of why violations of societal norms take place and can be minimized to promote better societal functioning.	2
			Total: 58

Further, as seen in Figures 1 and 2, most studies reviewed were exploratory and focused on developing new methods for persona applications. This was assessed by manually coding the unique research goals and contributions within each domain. In combination with the number of unique research goal and contribution categories in each domain, the number of unique empirical methods adopted in each domain provides a further overview of the scope of research output. As seen in Figure 3, a variety of empirical methods have been deployed in studies adopting PFSG, with a large majority adopting mixed methods, followed by case studies. Other empirical methods include interviews, focus groups, questionnaires, and experiments, as well as study-specific methodologies such as GPS data mapping [3] and word cloud visualization with Twitter data [29].

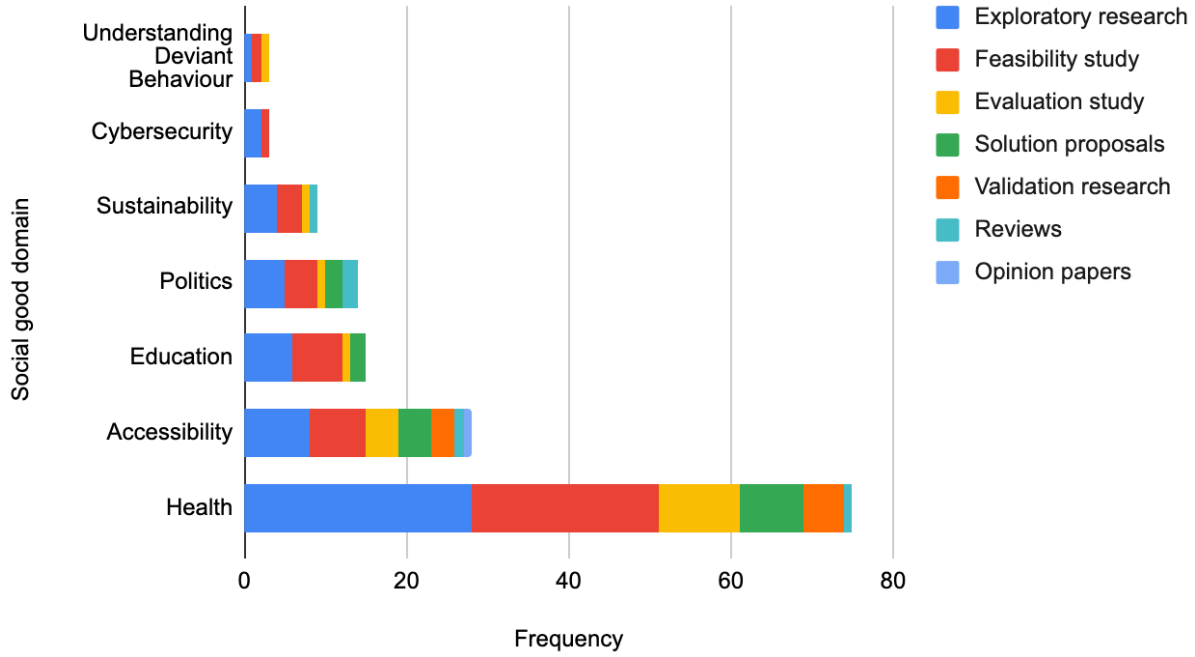

Figure 1: Research objectives of studies adopting personas for design solutions to social issues.

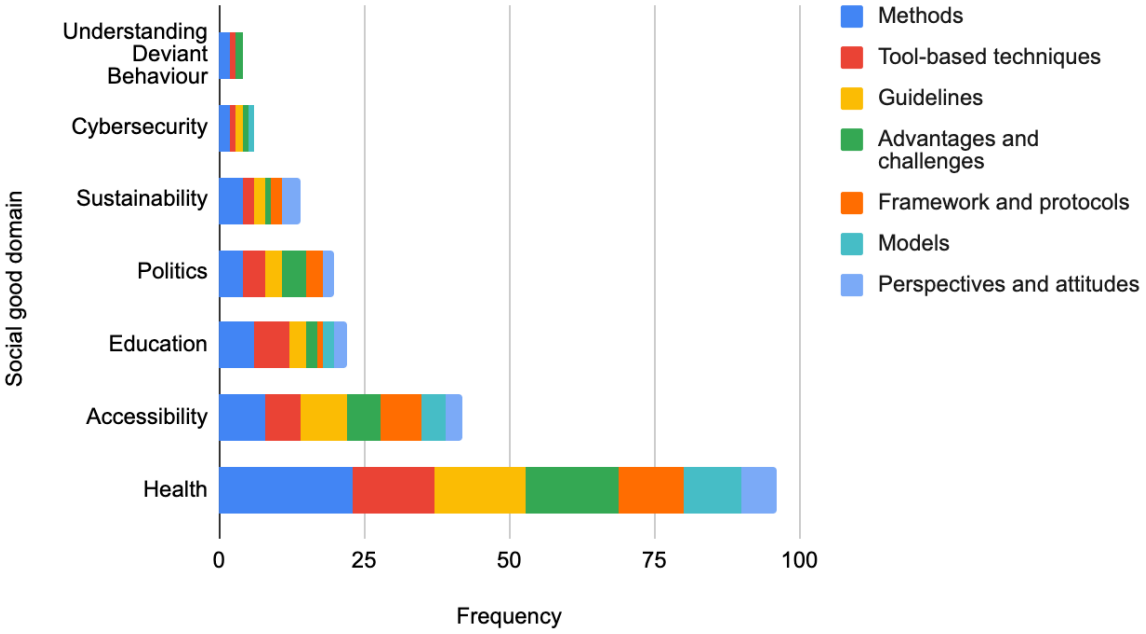

Figure 2: Research contributions of studies adopting personas for design solutions to social issues.

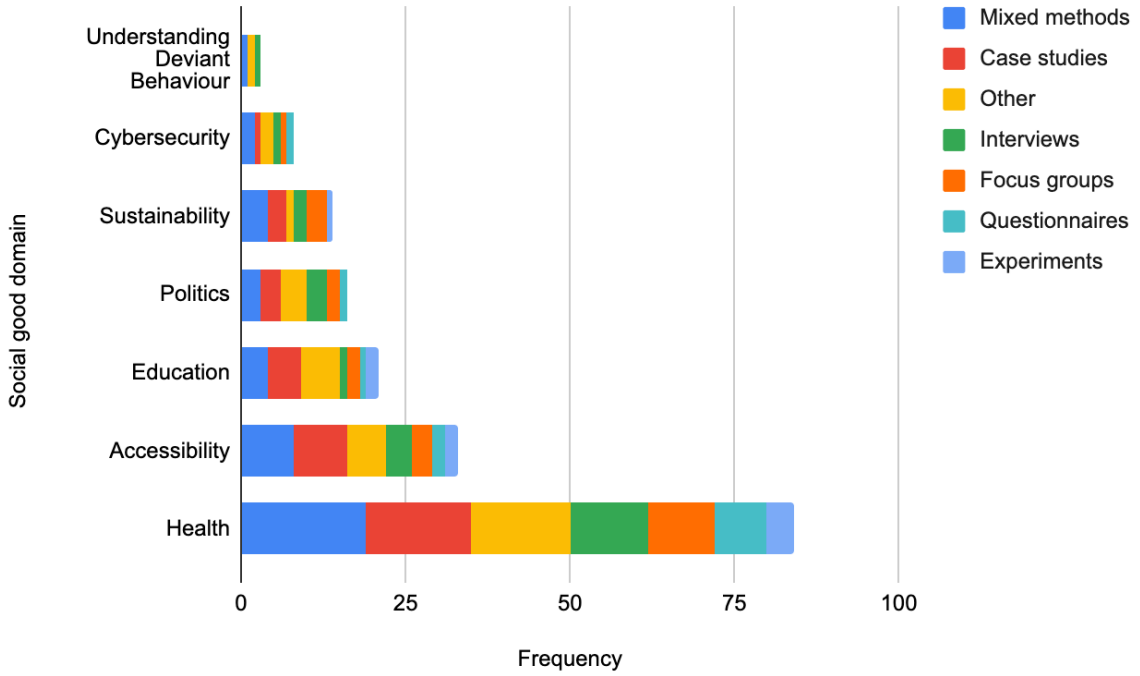

Figure 3: Empirical methods of studies adopting personas for design solutions to social issues.

Nevertheless, given the disproportionate number of studies in each category (e.g., health, N=28; understanding deviant behavior, N=2), it is not possible to meaningfully infer that certain social good domains are exploring more research goals or contributing more novel research to the field than others. Rather, the consistent prevalence of exploratory research and new methodology proposals across domains reflects the nascence and diverse applications of PFSG, and the high level of variance in contributions across domains further highlights the disproportionate application of personas in different domains. Given this, we summarize how personas were adopted in studies to fulfill social good purposes, alongside particularly noteworthy contributions in each domain, in the following subsections. These papers serve as models for how personas can be comprehensively applied for use cases within specific social good domains and later inform overarching frameworks for PFSG across domains. Indeed, these studies were precisely identified as they went beyond exploratory aims and new method proposals, for example, by considering the feasibility and/or by proposing standardized guidelines for future work in the field. This further strengthens the case for extracting key insights from these studies to guide frameworks for persona-based solutions to social dilemmas.

4.1.1Improve Delivery of Healthcare Services

Most papers adopting PFSG were concerned with improving healthcare delivery systems and services (50%, N=29). In each of these studies, personas included critical health-related information such as patient conditions, health practitioner needs, and healthcare service settings. Use cases within this domain were diverse, ranging from the enhancement of health informatics tools used by practitioners (e.g. [48]) and investigation of patient needs for the creation of new therapeutic tools (e.g. [17,59]). Personas are particularly suited for health applications as they comprehensively reflect individuals'

lived experiences across a spectrum of contexts – an especially critical trait in optimizing healthcare delivery, as a range of factors such as external circumstances and impaired functioning impact people's capacity to engage with healthcare services and receive effective care that improves their wellbeing. Therefore, personas can contribute to groups seeking to improve healthcare interventions and population outcomes.

A particularly noteworthy paper by Olivares et al. [47] created personas to guide the creation of assistive technology intended explicitly for traumatic brain injuries (TBI). Specifically, the usage of personas in the initial design stage required an iterative knowledge exchange between computer scientists and health specialists. In this way, this work offered a systematic example of how personas can be adopted to support interdisciplinary collaboration in socially impactful areas. By reporting the detailed processes by which different stakeholders in the research team collaborated using common, standardized reference points (e.g., the *Instrumental Activities of Daily Living* profiles), the authors demonstrate how personas can be flexibly adapted to pre-existing healthcare protocols familiar to experienced clinical practitioners. Incorporating multiple validation and evaluation steps (e.g., video observations, prototype assessments) by multiple stakeholders (computer scientists, clinicians, and internal and external assessors) further demonstrates how personas should be systematically assessed in their application to healthcare domains. The study, therefore, demonstrates how PFSG and be leveraged to go beyond mere portrayals of different patients so as to further foster cross-stakeholder synergies and co-creation opportunities between clinicians and engineers.

While the applicability of personas to enhance processes within healthcare systems shows promise, present studies offer little generalizability, and do not effectively address the wide range of practical concerns that healthcare stakeholders may have. For example, Hendriks et al. [25] intended to use personas to facilitate the discussion of needs with individuals with dementia, where personas could help elicit an imagination of how a potential assistive "technology could be integrated into their lives without having to use the terminology related to technology" (p. 661). The authors ultimately found that the persona "added a layer of complexity" to the participatory workshops and made the "intangible technology (…) even more intangible" to the participants, and subsequently chose not to continue employing personas in their study. This demonstrates the challenges of persona adoption in myriad health contexts, and the need for further research on the suitability of personas to elicit positive social impact for vulnerable populations.

4.1.2Increase Accessibility (Physical and Social)

The second most frequent domain concerned the promotion of accessible practices (17%, N=10). Use cases frequently included the adoption of personas to enhance participation in design activities and thereby enhance the accessibility of both design outputs and decision-making processes (e.g. [37,42]). In these articles, personas incorporated user preferences and requirements for mobility, alongside existing barriers to opportunity access. A particularly noteworthy contribution in this domain, authored by Chang [10], employed user personas to consider how the digital user experience can be enhanced for those seeking free legal information. The article is notable for its synthesis of personas within the context of local legislation and its attempt to systematically propose standardized guidelines for similar future work. Moreover, its inclusion of a model prototype (accessible via a live Github link) that follows these guidelines and directly demonstrates how the generated personas can be incorporated into different local frameworks is especially commendable. This level of depth and intentional translatability to future applications contributes to a more comprehensive understanding of PFSG for enhancing legal accessibility. The paper also roadmaps key steps for practitioners to directly replicate and base their future persona creation efforts, which promotes necessary standardization and quality control in the domain. The paper's inclusion of a live Github link is particularly noteworthy for promoting PFSG development beyond the existing study.

Among studies in the accessibility domain, fostering intercultural dialogue was a common subtheme (N=6). These articles created personas explicitly to improve inclusivity and diversity in designs, especially for underrepresented demographic groups. In these articles, personas featured information specifically intended to highlight diversity and facilitate cross-cultural communication (e.g. [2,16]). Personas were demonstrated to be a promising tool for eliminating barriers to diverse inclusion practices, with the mere practice of creating diverse personas demonstrating the value of incorporating multiple viewpoints and perspectives.

Nevertheless, studies in this domain were primarily individual case examples with disparate methodologies for enhancing accessibility. Moreover, few of the current studies have helped refine general evaluation measures for accessibility. Indeed, accessibility is a quality of holistic surroundings and/or experiences rather than a basic service [30], and encompasses integrated system processes to benefit end-users [55]. Given nuanced contexts across use cases, the diversity of different accessibility measures may impair the usefulness of personas across different accessibility-related contexts. For example, studies adopting perceived accessibility measures (i.e., user self-reported evaluations of accessibility) are qualitatively and pragmatically different from those adopting calculated accessibility measures. Thus, numerous challenges persist in using personas in accessibility-based planning, most saliently the evaluation and transmission of accessibility indicators for social good metrics.

4.1.3Enhance Civic Participation

The third most prevalent domain concerned the promotion of civic engagement (10%, N=6). Persona use cases in this domain included pertinent data on users' political ideals, civic actions, and impressions of governing structures. For example, Bodker et al. [8] developed personas to classify the general Danish population into subgroups according to preferred avenues for engaging with government bodies, in order to inform the design of efficient digital platforms for civic participation. Similarly, Kauppinen et al. [35] developed personas by identifying relevant concerns for motivating citizens to engage in political processes. In a noteworthy contribution, Moser et al. [44] showed how decision diagrams can be used to construct personas in three separate case studies. Their decision diagram sought to account for prior knowledge, research skills, sample size, and resource availability to help researchers determine what methods (e.g., primarily quantitative, qualitative, or mixed methods based on pre-existing knowledge) should be adopted in persona designs. It can be surmised that the motivation behind such an approach, which focuses both implicitly and explicitly on resource management, may be due to the authors' distinct aim of engaging underserved populations, which are, by definition, systemically under-resourced (e.g., elderly and young people), and therefore require an enhanced and more deliberate allocation of resources. Such an approach can be adopted across a variety of domains, as resources limit all projects by nature. Indeed, in any projects adopting PFSG, capacity building (i.e., the contribution of resources to realize sustained, socially beneficial transformations) should be of central focus.

Notwithstanding, across all studies in this domain, it was evident that civic participation encompasses a broad set of behaviors, with current persona research disparately considering different activities as indicators of civic participation. While this heterogeneity makes it difficult to replicate or translate results, it also reflects how demographic, political, and geographic differences in different locales may uniquely shape civic participation across jurisdictions. Personas adopted to expressly promote civic participation may, therefore, particularly benefit from grassroots (i.e., localized) assessments of community needs and infrastructural contexts, so as to combat sociocultural stereotyping and enhance relevance of social good aims to specific sociopolitical contexts.

4.1.4Optimize Pedagogical Quality

Education was another social good domain identified in the literature (10%, N=6). Use cases encompassed personas that not only reflected student/ learner goals but also addressed educational practitioner needs. For example, Brooks and Greer [9] created learner personas to provide guidance to instructional designers, academic advisers, and other institutional learning experts who specialize in developing learning interventions in educational settings. Similarly, Treuillier and Boyer [62] sought to determine how learners behaved online by incorporating learning indicators that represented the actions (interaction, activity, learning) of a particular learner into individual personas. By measuring these factors, the authors were able to classify student learners based on their behavior and identify areas necessary for individualized support. The authors demonstrated that even within a single subject class, not every learner would benefit from the same instruction, especially in big groups where students have a variety of backgrounds, goals, and talents. Personas enabled the evaluation of learning outcomes according to various student subgroups.

In a particularly rich contribution by Zanudin et al. [67], personas were constructed in conjunction with three main activities: gathering persona descriptions and identifying personas, recording scenarios based on given tasks, and testing the developed prototypes to gauge user satisfaction. Zanudin et al. [67] further demonstrated how learner personas could be systematically evaluated through subsequent scenarios and user acceptance testing. This study also used hierarchical task analysis to examine the participant tasks to systematically determine how effectively they were performed. As a result, the authors systematically implemented the persona-based approach to examine the wants, challenges, and circumstances of various users as inputs to design educational applications. The incorporation of mixed methods (i.e., hierarchical task analysis, and Likert scales for assessing user perceptions) further highlights how educational researchers can adapt personas to be more relevant to different learners via quantitative validation.

4.1.5Promote Ecologically Sustainable Practices

Sustainable development was an additional social good theme (N=4, 7%). A notable paper by Arian et al. [3] demonstrated how personas could to employed beyond single-level analyses (i.e., only one type of behavioral metric) to incorporate multiple measures (e.g., GPS, demographic, behavioral, and time-based data) in the corroboration and evaluation of PFSG. Arian et al. [3] aimed to investigate the efficacy of tailoring travel behavior change interventions for groups of people based on their trip purpose, activity restrictions, and schedule flexibility and also to determine the viability of changing actual behavior by using these travel behavior personas. A persona framework was first used to group users of the transportation system according to their past behavior, level of time flexibility, lifestyle, and socio-demographic status in conjunction with clusters of dynamic point cap thresholds (e.g., based on user arrival and departure trends). A field experiment was then conducted, in which actual users' trip data (i.e., GPS trajectories) were recorded via an app. Dynamic time warping was presented as a novel, algorithmic technique to validate the persona descriptions of users' responsiveness to behavior change incentives. This method allowed the authors to experimentally evaluate whether persona creation reflected a successful personalization of behavior change incentives. Such an ecological model for personas also captures how behaviors are shaped dynamically via interactions between individuals and their environment. Indeed, in the social sciences, more broadly, there has been a move to utilize different methods and levels of analysis (e.g., physiological, behavioral, institutional) to enhance the understanding of the multifaceted mechanisms of behavior change, including causal paths.

Similarly, in their study on the creation of green cohabitation spaces in urban environments, Tomitsch et al. [60] identified office workers and property owners in urbanized areas as key subgroups of urban dwellers and represented these groups in the form of personas. Non-human animal personas were also created, e.g., species of possums native to the urban

area. Both human and non-human personas were subsequently employed by designers in smart urban design decisions. For instance, the need for seating areas to be illuminated at night (i.e., automatic-activated light sources) was carefully considered in order to prevent increased light pollution and potential effects on possums and other nocturnal species. In this way, the authors demonstrated how non-human personas could be applied in sustainable contexts where human and non-human stakeholders are seen as equal users from the outset. This more-than-human perspective enables the identification of broader implications of urban innovation, such as the effects of novel sensor types on the functioning of local species.

4.1.6Mitigate Digital Vulnerabilities

Two studies (3%) adopted personas to mitigate cybersecurity threats. Kim et al. [36] evaluated user characteristics in terms of their knowledge of cybersecurity issues, how they utilize digital devices, and how they handle privacy concerns when using products. These traits were translated into eight personas that reflected the different user characteristics. In a particularly extensive research paper, Atzeni et al. [4] discussed how personas can enhance system security. The authors outlined a process for creating attacker personas using open-source data to characterize the behaviors of a system's typical attackers. Qualifiers enabled the researchers to consider the frequency and plausibility of the relationship between a persona, its corresponding characteristics, and the validity of its data source. Atzeni et al. [4] also notably demonstrated how different stakeholders (developers, security specialists, and usability experts) can collaboratively evaluate personas after their initial creation. The comprehensive incorporation of attack tree simulations in these discussions, including how attacker personas can be incorporated, exemplifies how security stakeholders can adopt personas dynamically throughout the design process. It further highlights the importance of validating and updating personas in the context of real perceived security threats.

Overall, these studies show how personas can aid designers in anticipating potential cybersecurity issues and as empathizing with potential users who may be exposed to these threats; however, the applications of PFSG in this domain remain nascent. Future papers adopting personas to address cybersecurity issues can employ similar decision-making processes to extract the most relevance from personas.

4.1.7Minimize Harmful Implications of Disruptive Behavior

Two studies (3%) adopted personas to better understand why individuals may violate societal norms and act in ways that disrupt societal functioning. Imperial [29] adopted personas to classify terminologies often used by child traffickers and peddlers. Twitter data was evaluated to analyze these individuals' most commonly co-occurring words. For example, it was found that to persuade potential victims to trade sexual content like images and videos for money, the *Peddler persona* frequently employed co-occurring keywords such as "direct message" or "avail" in their commercial dealings. Meanwhile, the *Propagator persona* represented individuals responsible for disseminating child pornographic content and frequently used words such as 'retweet' or 'follow' in their content posts. This study presents a novel integration of social media data to evaluate criminal subpopulations, which are challenging to access and evaluate in research.

In another study, Hilton and Henderson [26] described how personas can be adopted to highlight the perspectives of criminals (such as opportunity and risk assessment) based on criminal histories and first-hand accounts from criminals. These personas can then be used as a countering tool for the consideration of crime prevention initiatives. For example, in their study, four persona types for burglars were elucidated: the professional burglar who performs it as a full-time career, in contrast to the "calculating," "prolific," and "opportunist" personas who view occasional crimes as a convenient and simple method to make a little money.

Together, these two studies demonstrate how personas can be adopted to increase the understanding of deviant behavior. Nevertheless, given the lack of studies in this domain, it remains unclear what thresholds are necessary for ascertaining exactly what constitutes societal norm violations and to what extent different forms of "deviant" behavior may be more pressing for society to address. While these two studies demonstrate how personas can benefit the understanding of extreme criminal behaviors, it remains unclear how personas can be applied to more nuanced societal violations, e.g., petty juvenile offenses or crimes committed by intellectually disabled individuals.

4.1.8Summarizing Persona Contributions Across Domains: Key Implications for Social Good Applications

The papers in this section provide several novel contributions that can inform future applications of PFSG. Moser et al. [44] demonstrate the value of incorporating decision diagrams prior to persona applications, with a particular emphasis on resource evaluation. Such considerations are particularly crucial for social good projects involving traditionally under-resourced populations and/or phenomena, for example, minority groups and climate change behaviors. Olivares et al. [47] and Atzeni et al. [4] highlight the importance of the systematic inclusion of diverse stakeholder perspectives across multiple evaluation points when applying personas. This facilitates interactive persona co-creation, strengthening the usefulness of personas, as well as promoting a consistent and comprehensive validation of personas throughout the design cycles. In a similar vein, Arian et al. [3] and Zanudin et al. [67] convey how multiple levels of measurement can be adopted to complement persona creation, testing, and deployment. Such approaches further enrich the ecological validity of personas, as they capture multiple mechanisms of persona behaviors and thereby promote a deeper understanding of user groups. Finally, the Chang study [10] is unique for its systematic proposal of standardized benchmarks for comparable future work, its synthesis of personas within the framework of local regulations, and the inclusion of a live Github link that permanently disseminates a model prototype based on the paper's personas. In addition to fostering a deeper awareness of how personas may be used to improve legal accessibility, this degree of depth sets out crucial processes for practitioners to directly reproduce and build upon when developing personas in the future. This enables persona applications in this domain to maintain standards for quality control.

4.2 RQ2: Considerations of Stereotyping in PFSG

A limited number of articles (N=12, 21%) explicitly discussed concerns with stereotyping in personas. Among these articles, half (N=6) discussed this issue in-depth and referenced attempts to combat stereotyping throughout the persona creation process. For instance, Wilson et al. [65] adopted phenomenographic approaches to analyze user interviews. This method was selected explicitly in order to avoid stereotyping and to ensure that personas represented not just the similarities across but also the diversity and depth of user experiences. Interestingly, the authors speculated that critiques of personas (such as being stereotypical) might result from a general inclination to concentrate persona creation on users' perceived demands rather than their values (e.g., sociopolitical). The authors also emphasized how phenomenographic techniques may account for how different individuals value the same phenomenon in different ways; by focusing on individual perceptions, such an approach prevents the development of reductive causal explanations. Other studies that explicitly examined concerns with stereotyping placed a significant focus on participatory activities [15,32,58]. Such co-creation opportunities with users enabled the authors to go beyond "prototypical users grounded in stereotypes" and construct personas "defined by characteristics deemed important and relevant to our participants" [32:57]. It is important to note that while the lack of explicit acknowledgment of stereotyping in our overall sample is concerning, several studies adopted similar frameworks (e.g., participatory techniques, personas incorporating user characteristics such as values) to the papers described in this section. Our results may, therefore, simply reflect an oversight on the majority of authors' part, wherein

it is presumed that the mere presentation of such techniques is sufficient for combatting critiques of personas. Nevertheless, such critical reflection and explicit consideration of stereotyping should be incorporated in future work to enhance the social relevance of PFSG.

4.3 RQ3: Considerations of Social Impact in PFSG

PFSG inevitably also calls for attention to social impact metrics. Traditionally, personas have been evaluated either formally using technical metrics (such as the elbow method when using clustering for persona creation), or in an ad-hoc manner by asking a set of domain experts to evaluate personas' relevance. However, much rarer is the evaluation of personas' concrete impacts. Despite this rarely being seen in HCI studies, it should become more common, as the outcomes of personas' use ultimately determine whether the effort put into their creation was worthwhile. At times, approaching the situation from an outcome perspective can yield results contrary to other forms of persona validation. For example, if a persona increases empathy among members of *Group A* and *Group B* that hate each other, does it matter if the persona is not 100% accurate? If the answer is negative, researchers should prioritize social impact over a technical, data-driven approach to personas.

Among the studies we reviewed, more than half (59%, N=34) of papers did not explicitly evaluate the social impact of personas, despite creating personas in a domain related to social good. Instead, these studies only discussed the context of social impact when introducing their rationales for adopting personas; subsequently, the studies reported only results related to the content of the personas, with no linkage of this content with the earlier described social implications. This is perhaps unsurprising, given the disproportionate emphasis on theoretical and/or technical accuracy in HCI, versus efforts to translate research studies to socially beneficial interventions. Among the studies that did consider the social impact of the created personas, most papers (36%, N=21) only anecdotally evaluated social impact. These typically included unsubstantiated and very general comments about how the personas were useful to the design team, and largely consisted of only very brief descriptions (e.g., a few sentences in the discussion section). Still, papers that went beyond brief descriptions to evaluate social impact often did so retrospectively, i.e., without having specifically sought to assess impact when initially creating the personas. Indeed, a large majority (86%, N=50) of papers did not include any concrete metrics for evaluating social impact. This is particularly concerning for PFSG (versus general or commercial personas), as their systematic assessment is crucial for determining the relevance and fulfillment of social impact objectives. We surmise that this significant gap may reflect the nascence of PFSG research and authors' tendency to presume the significance of their work as a result, in addition to a lack of standardized indicators PFSG within and across domains. It should be noted that the PFSG use cases in our sample were inherently novel in their social applications beyond predominantly commercial contexts. Yet without explicit evaluation of social impact upon PFSG creation, there remains a gap in understanding (a) how personas contribute value to the populations they represent or (b) how personas can be leveraged in different ways for different social impact goals. For example, in healthcare, different types of delivery staff and treatment intervention intensities are key contextual considerations affecting patient groups and the personas derived to benefit these patients. Key performance indicators can therefore be used to determine the extent to which certain personas and persona creation techniques are more applicable to certain contexts (e.g., private hospitals in higher income nations or low resource clinics versus community health centers in low- and middle-income nations, or certain patient demographics versus others).

Finally, only 16% (N=9) of the papers we reviewed considered resource allocation. This was surprising, as sectors concerned with social good necessitate socially impactful interventions precisely because they are resource-constrained, and persona applications that require significantly greater time, expert knowledge, and materials than those typically available are unlikely to be adopted. Indeed, only three papers in our sample (5%) were conducted in non-profit settings,

and all of these studies were performed in partnership with academic research teams. This further reveals the gap in use cases of PFSG in the field. However, practical insights were shared in the papers that did consider resource management. For example, Moser et al. [44] shared a novel decision-making diagram for persona creation focused on resource management and discussed how collecting data via telephone interviews (versus sending out postal questionnaires) may be more suitable for time-constrained practitioners. In another paper, Chisik et al. [12] discussed how an earlier-planned persona creation workshop shifted online due to the global COVID-19 pandemic. As a result, the authors restructured the workshop to consider the difficulties presented by the conference's virtual nature and the constraints of working from home. The authors also considered how digital mediation and the incapability to physically exchange prototyping materials impact workshop processes. Given the long-lasting effects of the pandemic and its transformation of societal communication, such evaluations will likely become increasingly relevant in studies pertaining to PFSG.

5 DISCUSSION AND FUTURE RESEARCH DIRECTIONS

5.1 Discussion of Findings

Personas are versatile, and customizable to several different applicable design contexts. The results from the field are indicative of personas' appeal for complex problems that involve multiple stakeholder parties at multiple levels in multiple organizations, as typically is the case for social dilemmas. Nevertheless, there remains a lack of persona usage in many specific fields outside HCI, politics, and criminology. However, this underutilization of PFSG may not necessarily be characteristic of personas' value relative to other user-centered design tools, but rather we surmise that it is a consequence of the HCI discipline's general disregard for social dilemmas [23]. HCI tends to be focused on micro-level (i.e., user/individual) rather than macro-level (society/system) perspectives. Hence, there is a lack of studies that aim for a broad understanding of complex problems (e.g., systems science [43]). This observation is not necessarily criticism, as many remarkable contributions have been achieved with such focus. Rather, it is a characterization of how HCI fits in with social dilemmas, implying that improvement in this regard is needed. More specifically, personas can be instrumental in understanding subpopulations at the unit of analysis of large-scale social dilemmas.

In the current study, we found that the most socially impactful personas integrate various approaches, such as focus groups, psychometric questionnaires, and interactive user testing, to inform and bolster socially conscious design decision-making. Among the articles reviewed in this study, particularly novel contributions of PFSG include the following: [3,4,10,44,47,67]. Nonetheless, further standardization efforts are essential to more reliably evaluate the *social impact* of personas. Additionally, conceptual research is necessary to chart distinct issues requiring effective social change and to conceive the adoption of personas to projects that address these social challenges. A crucial factor is to surpass the focus on persona creation and their validation and *truly* shift the focus on applications. Here, a key question to be explored is: *How do personas actually produce benefits for end users and society at large?*

It can be argued that the technical accuracy or 'validity' of the personas (which authors often spend a lot of research effort and energy to establish) is perhaps less important than a positive social change that can be brought about using a slightly flawed persona. Even though our study exclusively focuses on reviewing articles that report persona use, their assessment for social change remains superficial and predominantly exploratory, rather than evaluating any actual social impact of persona usage. That is, the studies included in the present review rarely evaluate the extent to which persona usage is significantly associated with socially impactful outcomes, with most studies testing the feasibility of persona usage from a technical and user participatory standpoint. As our results indicate, the depth and rigor of the current body of literature are inadequate in providing a linkage between a favorable reception among stakeholders to tangible actions taken

to alleviate social dilemmas. The allocation of resources to persona creation should also be considered in light of contextual constraints such as logistics and costs. Similarly, given the significant resources that are deployed in persona creation studies, future investigations should determine if persona-assisted design genuinely results in a greater level of social impact than in contexts when personas were not used throughout the design process. Quantifying this distinctive value of persona use for social impact requires robust methodologies, such as randomized controlled trials, in conjunction with ethnography and general UCD. Only by systematically evaluating the effects of persona use alone and also in conjunction with other UCD approaches on social impact outcomes [24], will researchers be able to more effectively and ecologically study the social value of design personas. Such considerations enable the consistent re-appraisal of persona creation feasibility, and in turn, their sustainable applicability to social good.

Finally, resource management assessments concerning persona usage must also be situated within specific social impact frameworks such as the UN SDGs, which ensures that persona creation can facilitate social impact beyond their immediate context and/or user group. The 17 SDGs represent a global consensus on areas pressing for social change, and persona creators should consider these challenges when prioritizing areas of persona application. In light of these factors, we propose an ecological framework for PFSG (Figure 4). Our framework lends credence to personas' applicability to larger social dilemmas (as identified by UN SDGs) while keeping target populations (i.e., the primary beneficiaries of social impact interventions) at the root of persona creation and decision-making. This framework recognizes the role of personas as boundary entities that enable designers to pay attention to user needs that may otherwise go undetected [41], and the crucial importance of situating persona studies within larger, macro-level considerations that both inform persona design as well as necessitate their creation in the first place. With the aid of this ecological framework, researchers can align persona creation processes to the needs of the target user and larger social issues and also discover new, pertinent levels of inquiry. Such a knowledge transfer helps designers to avoid the inclusion of extraneous features demanded by stakeholders and effectively advocate for users' needs.

As seen in Figure 4, the core of the ecological framework is the target group, whose demands are acknowledged as the foundation of persona building activities. Table 4, in turn, demonstrates how each of these ecological levels can be incorporated into the persona application, using the example of children with intellectual disabilities, a disadvantaged and vulnerable group in society that remains neglected by existing social systems (for examples of how personas have been applied to support individuals with disabilities, see [15,19,42,57]). The first step in PFSG creation requires to identify the individuals suffering social challenges, i.e., who the personas should serve. During the second step, initial personas are prototyped to depict different types of user challenges in empathic, accessible formats for decision-making and communication among stakeholders. The third step concerns further refinement of the personas created in Step 2, by considering the overarching implications of resource management for persona creation and subsequent social impact evaluation. For instance, there may be an insufficient number of children with disabilities and/or relevant domain experts locally to conduct personal interviews with; moreover, this subpopulation may be particularly burdened by traditional interviews and/or participatory design activities. As such, critical reflection on resource management at this stage may necessitate reliance on digital, open-access survey data or interviews with parents for persona creation. Such insights may not be immediately apparent during initial persona development (Step 2) but nonetheless constitute important, larger practical considerations that impact the scalability of PFSG. These considerations are also particularly important as they help to ensure the sustainability of persona applications beyond creation, enabling necessary updating and dissemination beyond their original stakeholder team.

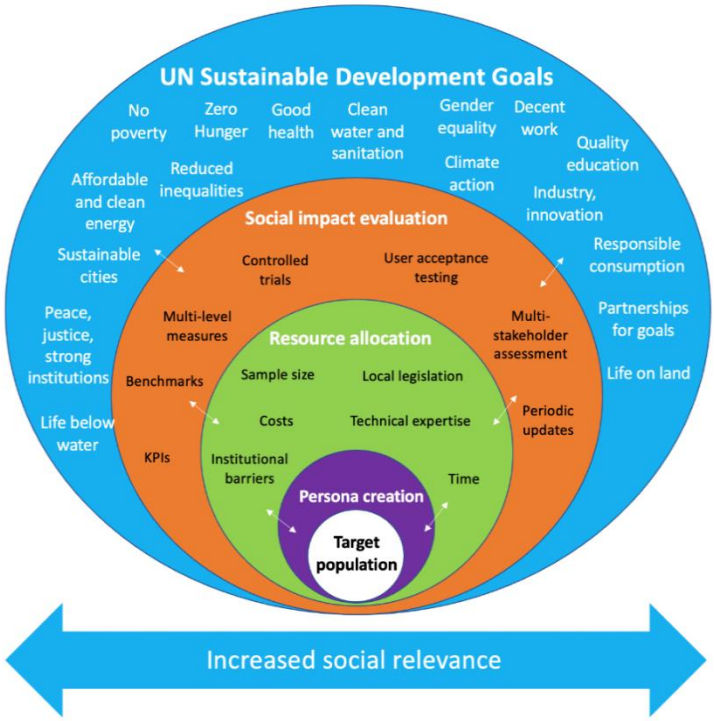

Figure 4: An ecological model for applying personas for social good. Attention must be given to multiple levels of factors: the target population serves as the primary basis and root of decision-making, while systematically taking into consideration the larger environmental, institutional, and social impact goals.

Table 4: Ecological levels to consider when creating personas for social good, with example applications.

Step	Ecological level	Explanation	Example considerations
1	Target population	The people facing social challenges and for whom the research is designed to help.	Disadvantaged and vulnerable groups, e.g., children with intellectual disabilities.
2	Persona creation	The humanized representations of the target population segment are presented in an empathic digestible form.	Prototyping of representative archetypes for target population (children with intellectual disabilities), with contextual details about existing social challenges (e.g., daily obstacles faced).
3	Resource allocation for further person development	Identification and management of assets supporting social impact research employing personas.	Low sample size of local members of the target population (children with intellectual disabilities) to interview may warrant persona construction and evaluation with digital, open-access survey data (versus interviews).
4	Social impact evaluation	Analysis, monitoring, and reporting of consequences and changes of research employing the personas.	Controlled trials to evaluate outcomes of persona usage, i.e., whether it provides a solution to challenges of the target population (children with intellectual disabilities).
5	UN Sustainable Development Goals	Seventeen related global aims are identified by global stakeholders as urgent and key overarching issues faced by target populations.	UN guidance on the SDGs 10 (reduced inequalities) and 4 (quality education) are both applicable for understanding challenges faced by children with intellectual disabilities.

The fourth step consists of an evaluation of the social impact of the personas. In line with the ecological framework, this social impact evaluation importantly builds upon and is directly tied to the needs of the target population and relevant resource management contexts identified in the prior levels. Several methods can be deployed, such as multi-stakeholder assessments and/or controlled trials to evaluate outcomes of persona usage on alleviating disability challenges. Guidance is ideally sought from domain experts on the particularities of the given context, such as specialist disability clinicians, which can help to align personas with beneficial use cases and prevent reductive stereotyping.

Finally, we urge the alignment of these prior, cumulative assessments within larger, standardized social impact benchmarks such as the SDGs framework, which form the fifth and final overarching level/step of PFSG creation processes. The SDG framework was created to ensure that social impact solutions at global, national, and regional levels function successfully via integrated and coordinated initiatives. UN guidance on reducing inequalities (SDG10) and quality education (SDG4) strengthen the persona creators' understanding of the issues faced by the target population. Consideration of the SDGs also addresses the possibility of how personas can be utilized to influence or develop new goals and activities for various societal challenges.

5.2 Practical Implications

The key message to practitioners is to go beyond creating personas and conducting shallow and anecdotal validations and to truly shift the focus to applications. As this study has highlighted, the usage of personas in designs for social good remains relatively nascent. Practitioners and researchers addressing social good concerns can consult our ecological framework and critical appraisal checklist in order to better align persona creation with social impact goals. We encourage the participation of all user and stakeholder categories in the development of personas for particular services and/or tools, including, but not limited to, the target population for the services, subject matter experts regarding the target population, stakeholders pertinent to the practical service design, and associated governmental organizations. Furthermore, we advise persona creators to work closely with each of these stakeholder groups throughout the entire design process. This calls for both an understanding of the various professional and social contexts of these groups, as well as co-creation techniques that facilitate interaction and collaboration between extremely diverse types of professionals and user groups. As personas continue to be adopted in socially impactful projects, future investigations should also examine the differences in how personas are used for different types of social impact projects.

PFSG can also be incorporated into HCI curriculums. A prominent example is from the University of Washington's Information School, which has defined a strategic plan for using HCI for social good, specifically mentioning valuable use cases such as "*accessible computing; child-computer interaction; computing in education, health and wellness; information for marginalized and vulnerable people; information/data visualization for individuals and society; personal information management; sustainability and design; and value-sensitive design.*"[1] Incorporating personas into societally geared HCI education is likely to benefit educational goals, as personas are easily accessible to students.

Overall, each accumulative step and level of the ecological framework we proposed in Figure 4 includes individual level, local, and global contexts. The main advantage of using this encompassing and stepwise framework is its emphasis on how each progressive level interplays with the others while placing the challenges faced by the target population at the root of decision-making. This framework acknowledges the dynamic and systemic nature of social issues, facilitating a multi-system level understanding and systematic, hierarchical strategy for designing PFSG. Alongside this ecological

[1] HUMAN-COMPUTER INTERACTION FOR THE SOCIAL GOOD https://ischool.uw.edu/about/ischool-2018/human-computer-interaction-social-good

framework, we also encourage researchers to frequently conduct critical appraisal processes of PFSG projects. For this, we have tentatively constructed a structured checklist to highlight key considerations:

1. **Are stereotypes mitigated?**
   - participatory techniques
   - user-based assessments of representativeness
   - diversity and inclusion training for researchers
2. **Is social impact evaluated?**
   - anecdotal/vanity (i.e., superficial report)
   - numeric (e.g., 50 kids learning to read)
   - mixed method (e.g., quantitative and qualitative methods reasonably implemented)
   - rigorous controlled trial (i.e., personas are the intervention whose effect is isolated)
3. **Are social impact key performance indicators (KPIs) / success metrics identified?**
   - tied to the use of personas
   - measurable over time
   - standardized
   - relevant to the industry/field (e.g., pre-existing scales used by practitioners)
4. **Are stakeholders inclusive and clearly defined?**
   - end-users/target population for social impact are part of the evaluation process
   - sample frame for population identified and clearly presented
   - domain experts (e.g., non-profit workers)
   - persona implementation experts' participation extends beyond persona creation
   - *i.e., ideal team for successful implementation of personas includes all of the above*
5. **Is the persona application feasible?**
   - data and methodology presented in sufficient detail for evaluation
   - repeatable (i.e., the personas can be reused)
   - scalable (i.e., the personas can be applied beyond the specific context to similar contexts within the same field)
   - specifies long-term goals
   - use of personas leveraged for achievement of specific objectives
6. **Is the persona application sustainable?**
   - considers resource allocation
   - outlines monetary costs
   - discusses funding options
   - personas currently implemented and in use
   - approach viable for persona updating and implementation

5.3 Limitations

As with any research work, the present review has limitations. First, while several papers utilize personas, we confined our inclusion criteria to studies that specifically employed personas while designing goods and/or services in domains concerned with social impact. This strict criterion excluded articles that employed personas created solely to gain a deeper understanding of subpopulations because they were not used to inform socially relevant design. Our sample is also inherently biased, as studies which critique the feasibility of personas for social good are unlikely to present persona

creation findings. While this restricted scope is important to address the current research questions, it limits the generalizability of our findings.

6 CONCLUSION

Since their initial application in software development and HCI, personas have been employed in many social good domains, including healthcare and education. However, the current contribution of personas to addressing social challenges in these domains is unclear, with most studies focused on persona creation from a technical rather than socially conscious standpoint. There is a need for a more intentional examination by researchers regarding how personas in social good domains can explicitly achieve social good goals. Persona creation in these domains must see a shift from practical and methodological considerations to active engagement in addressing the needs of target users and larger global issues. To facilitate the scalability of socially beneficial and sustainable persona creation across contexts, researchers are encouraged to adopt an ecological paradigm to persona creation that encompasses target population needs, concrete social impact evaluations, resource allocation, and larger societal challenges on a global scale.

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