CHAPTER 5

STRUCTURED AND ADVANCED MODEL OF PERSONAS (MEAPs)

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ABSTRACT — This study presents the Structured and Advanced Model of Personas (MEAPs), an innovative approach to modeling specialized user profiles, grounded in multidimensional empirical analyses and strict methodological rigor. MEAPs promotes the systematic integration of technical, behavioral, and contextual variables, aligning with a holistic perspective of the interaction between agents and technological objects. The methodology systematizes data extracted from detailed analyses and evaluations, structured according to the multidimensional technical-scientific matrix of the Integrated and Advanced Core Framework for the Analysis and Evaluation of Technological Objects (FCIA-OT). Unlike traditional models, which produce static personas with limited representativeness, MEAPs configures a dynamic, iterative, and versioned structure, capable of adapting profiles in response to behavioral variations and emerging user demands over time. This structure enables the generation of specialized profiles, including technical agents, accessibility experts, and sustainable technology specialists, supporting the development of inclusive, efficient, and responsive technological solutions. The implementation of MEAPs enhances decision-making in agent-centered design, promoting the rigorous alignment of technical and functional requirements with the actual expectations of agents. The model ensures the structured transfer of technical knowledge across multiple stakeholders, strengthening collaborative processes and ensuring traceability and evolutionary control over persona versions. This research makes a significant contribution to the advancement of usability engineering by providing a systemic and robust model capable of supporting the complexity of contemporary technological environments and fostering continuous innovation in the development of objects and interfaces.

KEYWORDS — Model; Personas; Multidimensional; Usability Engineering; FCIA-OT; MEAPs.

1 INTRODUCTION

A deep understanding of the interactions between users and technologies requires methods that reveal not only observable behaviors but also the meanings embedded in everyday practices. Anderson (1994) argues that ethnography, by capturing implicit contexts and the layers of complexity involved in system use, significantly expands designers' ability to interpret users' "lived work." This integration of ethnography and design can lead to the development of systems that emerge from concrete reality and meet user needs.

In the field of user-centered design, the construction of personas has become a relevant methodological strategy for representing target audiences. Cooper (1999) proposes a conception of personas that breaks with the logic of arbitrary fictionalization: these are carefully discovered archetypes, not invented ones, whose construction is grounded in empirical evidence. This approach aims to replace vague generalizations with precise representations capable of guiding product development in accordance with real demands, avoiding decisions based on subjective assumptions.

However, the effectiveness of personas depends on the quality of their foundation. Blomquist & Arvola (2002) warn of the risks of superficiality in creating such profiles, especially when they lack support from verifiable data. In such cases, designers tend to question the relevance and reliability of superficially created personas. When anchored in empirical data and articulated through coherent usage scenarios, personas acquire operational value and allow design teams to visualize interactions iteratively, contributing to the development of contextualized tasks and functionalities. Based on this analysis, the strategic value of personas lies in their concreteness and dynamism, provided they are continuously reassessed according to design goals and system evolution.

Given these conditions, the need for robust models that overcome the limitations of traditional approaches to persona creation becomes evident. This study proposes the Structured and Advanced Model of Personas (Modelo Estruturado e Avançado de Personas – MEAPs), based on a multidimensional approach that combines empirical data with technical-scientific foundations to accurately represent diverse agent profiles. The methodology presented aims to strengthen agent-centered design by offering a dynamic and adaptable framework that reflects the complexity of interactions between agents and technological objects in real and varied scenarios.

2 STRUCTURED AND ADVANCED MODEL OF PERSONAS (MEAPs)

The specialized literature has increasingly emphasized the need for more refined methodological approaches in the development of personas, particularly those capable of incorporating variables such as accessibility, diversity of usage trajectories, behavioral transformation, and other critical aspects that shape usability and interaction with technologies. Based on this scenario, the proposal to construct technical and specialized personas, supported by the 12 integrated dimensions of the FCIA-OT, represents a substantial advancement in the field. This structure combines analytical precision and design strategy, establishing a novel model for composing and articulating highly qualified profiles.

When applied across different technological contexts, this approach enables a truly multidimensional analysis, integrating behavioral, social, and technical-operational elements. The proposed methodology not only deepens the understanding of relationships between agents and complex constructs but also fosters more inclusive, responsive, and sustainable design solutions.

However, it is essential to emphasize that the effectiveness of this model depends inextricably on the quality and empirical representativeness of the data that underpin it. In this framework, the construction of personas surpasses an illustrative function: it becomes an analytical and strategic tool, precisely guiding system design in contexts that require a high degree of personalization, technical specificity, and functional responsiveness..

2.1 Theoretical Foundation and Technical Structure

The consolidation of personas as a strategic tool in interaction design depends primarily on the methodological robustness with which they are constructed. Pruitt & Grudin (2003) argue that the value of personas lies in their ability to synthesize qualitative and quantitative data into believable user representations, provided that their characteristics are explicitly anchored in the evidence supporting them. This link between data and attributes is essential to ensure reliability and to allow personas to extrapolate beyond the original scenarios, becoming useful tools in prospective design decisions.

Despite the recurring adoption of interviews and ethnographic practices, Faily & Flechais (2011) emphasize that these approaches, when used in isolation, do not guarantee the necessary validation to confer accuracy to personas. To address this weakness, they propose "Persona Cases", constructs based on narratives traceable to original empirical data, supported by rigorously articulated argumentative

propositions as "grounds" or "warrants." This structure endows personas with a justifiable and auditable dimension, making them compatible with technical evaluation standards.

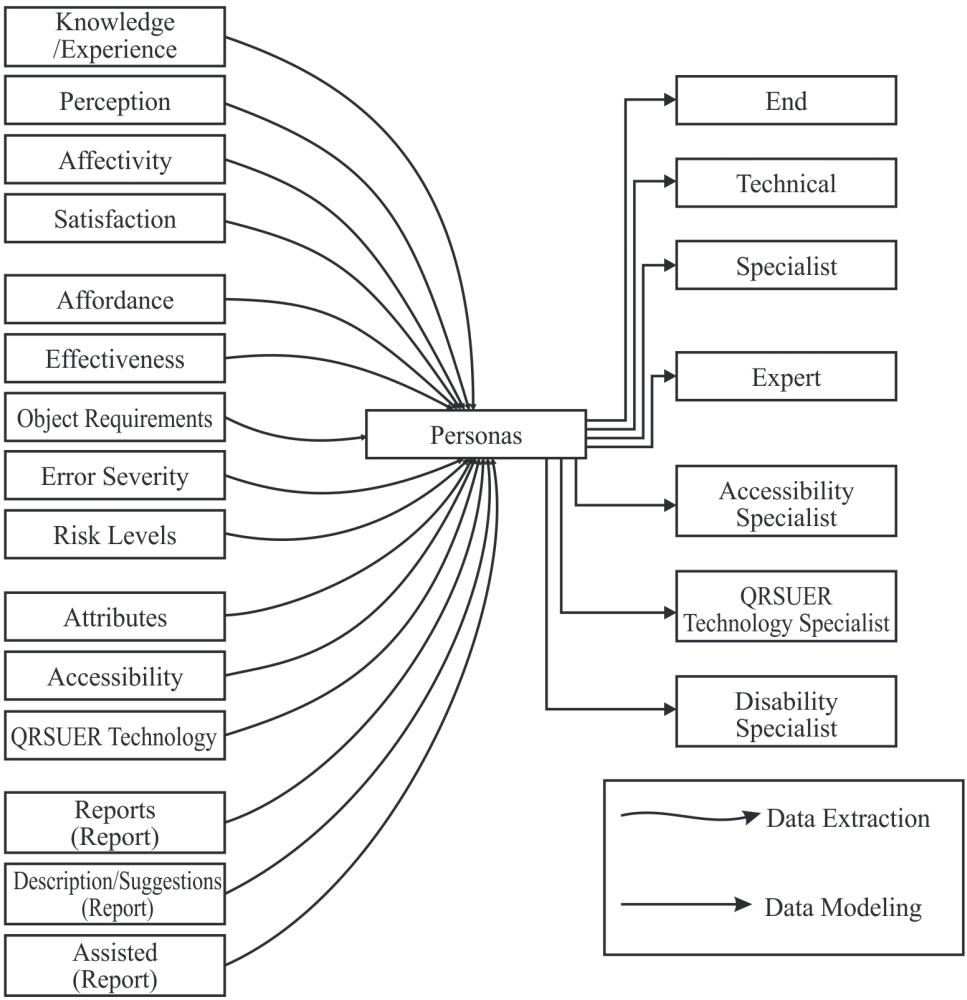
Along similar lines, Miaskiewicz & Kozar (2011) observe that although the benefits attributed to persona use are recurrent in the literature, few studies clearly delimit their more universal advantages. They highlight, however, a convergent point: well-founded personas facilitate alignment between design teams' objectives and users' real expectations, operating as more tangible mechanisms of target audiences.

Complementing this panorama, Faily & Lyle (2013) identify structural gaps both in the literature and in tools aimed at persona creation, maintenance, and version control. They state that persona effectiveness depends on the articulation between data, narratives, and solid argumentation models that validate the inferences incorporated into the profile.

Based on this theoretical foundation, the process of constructing Specialized Personas within the MEAPs model, structured around the Systemic Matrix of Integrated Vectorial Dimensions (MSDVI) of the FCIA-OT, significantly expands the scope and precision of these representations. The model enables the development of profiles adaptable to varying levels of technical complexity, ranging from generalist contexts to highly specialized niches. Its architecture overcomes the rigidity of static representations by incorporating iterative mechanisms and continuous adaptability to evolving contexts.

The flowchart depicted in Figure 1 illustrates this process, highlighting the articulation between empirical data, technical-scientific criteria, and modular analytical structures. The result is a robust system for persona characterization and evolution, precisely responding to the demands of highly dynamic, complex technological environments oriented toward functional specialization.

Figure 1: PROCESS OF DEFINITION AND STRUCTURING OF PERSONAS WITH SPECIALIZED PROFILES



This flowchart systematizes the technical composition of specialized personas according to the Structured and Advanced Model of Personas (MEAPs), articulating empirical data, technical-scientific criteria, and modular analytical structures. The profiles are derived from analyses and evaluations based on the multidimensional FCIA-OT matrix, structured through the SPMI and SCDMIC instruments and measured using the SGUI and SCMI systems. Each profile incorporates quantitative and qualitative parameters, allowing for measurable densities defined by specific scales: scores (SPMI), chromatic volume (SCDMIC), and technical-operational indexes (SGUI and SCMI). This innovative configuration assigns the personas a functional, dynamic, and traceable character, elevating the modeling process to the status of a strategic component of high design precision. A complete description of the empirical analyses, instruments applied, and case studies is provided in Chapter 4.

Source: Author.

This integration, summarized in Figure 1, systematizes the technical process of constructing specialized personas, highlighting how the articulation between empirical data and analytical dimensions enables the composition of robust, traceable, and functionally adaptable profiles. By incorporating validation criteria, iteration, and version control, the MEAPs model establishes a new methodological standard in the field of technology-oriented interaction design, serving as a foundational framework for strategic applications in complex environments with high design demands.

2.2 Systemic Structuring and Definition of Persona Profiles according to MEAPs

The use of personas in system design has been widely debated from different theoretical and methodological perspectives. Matthews, Judge, & Whittaker (2012) warn about the risks of including irrelevant information in persona construction, such as domestic habits or generic preferences, when these do not directly relate to the design problem. Under such circumstances, artificial constraints are created that divert the focus from design. Therefore, the relevance of selected data must be carefully evaluated, prioritizing information that genuinely contributes to problem delimitation and solution formulation.

Within the context of User-Centered Design, Cabrero, Winschiers-Theophilus, & Abdelnour-Nocera (2016) indicate that personas play an essential role in communication between technical teams and users by representing collectives with shared technological goals. These representations, when grounded in empirical data, allow the illustration of real motivations, expectations, and needs, fostering the development of solutions more aligned with the user experience.

The analysis by Graus & Ferwerda (2019) reinforces this understanding by pointing out that personalized systems, although capable of predicting behaviors based on historical data, rarely link such inferences to theoretical models of needs. The integration between behavioral data and robust conceptual frameworks enhances the reliability and scope of personalization strategies. Notably, Huang (2024) criticizes the rigidity of traditional UX approaches, highlighting the insufficiency of models that neglect continuous feedback and the heterogeneity of usage profiles. Well-constructed personas prove especially effective when direct access to users is limited, providing designers with a more accurate basis for critical design decisions.

According to this research, the Structured and Advanced Model of Personas (MEAPs), grounded in the 12 technical-scientific dimensions of the FCIA-OT, introduces a systemic and evolutionary approach to profile definition. These profiles are directly derived from analyses and evaluations conducted by agents, stored in a database that enables iterative reconfigurations and the maintenance of traceable versions.

This database is constituted from empirical results extracted from case studies applied across different domains (see Chapter 4), such as software analysis and evaluation, air conditioning control systems, and unmanned aerial vehicles (UAVs). These studies provide individual and aggregated data that underpin the construction of persona profiles, allowing adaptive combinations and precise definition of the most suitable profile for each usage context. This model surpasses the static limitations of conventional personas, offering an innovative, dynamic, adjustable, and verifiable structure. The main structured profiles proposed in MEAPs are as follows:

End Persona: Represents agents in real usage situations, with varying levels of technological familiarity. Data is processed based on the 12 integrated dimensions, enabling the identification of usability barriers, accessibility needs, and opportunities for functional improvement.

Technical Persona: Corresponds to agents with operational technical mastery of objects. It contributes to specialized diagnostics and evaluations of functionality, performance, and compliance. Essential for guiding adjustments in constructs, hardware, software, and integrated devices.

Specialist Persona: Encompasses professionals with expertise in specific areas. Its role focuses on advanced analysis of integrations among subsystems and platforms, performance modeling, and evaluation of critical operational requirements.

Expert Persona: A highly qualified profile with interdisciplinary capacity to lead innovation processes. Strategically guides systemic improvements, aligning technical performance with market demands.

Accessibility Specialist Persona: Focuses on agents skilled in inclusive norms, guidelines, and practices. Evaluates technologies from the perspectives of accessibility, perception, and affectivity, promoting solutions compatible with universal design.

QRSUER Technology Specialist Persona: Gathers technical, social, ethical, and sustainable competencies, operating under the pillars of Quality, Social Responsibility, Sustainability, Usefulness, Ethics, and Reason. This persona contributes to the development of technologies with high systemic impact.

PCD Specialist Persona: A profile dedicated to evaluating the interactions of persons with disabilities with technological objects. Possesses normative and practical expertise in proposing equitable and accessible solutions, based on real data collected during evaluations conducted with PCD agents.

All these profiles operate as technical-scientific vectors that articulate empirical data obtained via FCIA-OT with structural guidelines for innovation. Their composition not only guides project and validation stages but also promotes the transfer of specialized knowledge (technical know-how) among stakeholders. Profiles may

be combined, generating hybrid and complex compositions, whose versioning is controlled by management mechanisms integrated into the database. This resource ensures traceability, continuous updates, and alignment with evolving technical-operational requirements.

By integrating empirical knowledge, technical modeling, and specialized representations, MEAPs consolidates itself as a systemic, strategic, and operational resource for the development of technologies centered on real usage conditions. Its application fosters professional specialization and continuous refinement of processes, promoting an approach driven by complexity and design precision.

The application of MEAPs transcends descriptive function by constituting an analytical tool aimed at verifying the functional maturity of objects. Each structured profile enables confronting evaluated constructs with empirical parameters derived from agents' real interactions, allowing the identification of critical misalignments between design objectives and user experience. This approach grounds precise interventions in the development cycle, guiding adjustments that enhance efficiency, adaptability, and technical adherence of systems to the operational contexts for which they are intended.

3 DISCUSSION

The consolidation of the Structured and Advanced Model of Personas (MEAPs) addresses critical gaps identified in the specialized literature regarding the precise, dynamic, and functional representation of agents, especially in contexts demanding inclusive, responsive technological solutions tailored to profile variability. MEAPs' contribution becomes particularly relevant in light of challenges highlighted by Lee et al. (2021), who point out that a significant portion of disabilities is acquired over a lifetime, increasing the need for design approaches that consider this continuous process of transformation of human capabilities. By incorporating specialized profiles, such as the Accessibility Specialist Persona and the PCD Specialist Persona, the model anticipates and mitigates usability barriers that are often invisible, ensuring greater equity in interaction.

From the same perspective, Bern Jordan et al. (2024) emphasize that the creation of personas representing people with disabilities remains limited, compromising representativeness in technology design. MEAPs, built upon observational data, empirical evaluations, and active participation of assessing agents, guarantees greater density and fidelity to real experiences, especially when technical and contextual narratives are combined. This approach endows profiles not only with descriptive value but also with argumentative power, capable of guiding technical and strategic decisions with higher precision.

From the interface standpoint, Kaate et al. (2024) indicate that the way personas are presented and interact with users directly affects their effectiveness. In MEAPs, the visual and textual structuring of profiles is guided by criteria of intelligibility, adaptability, and design precision, allowing complex data to be translated into comprehensible and operational artifacts without losing technical-scientific depth.

Another fundamental aspect lies in overcoming the static and generalist limitations observed in traditional models. Farhat-Ul-Ain et al. (2024) warn about the absence of behavioral change objectives and adaptive mechanisms in common personas, which compromises their applicability in complex interventions. MEAPs, being dynamic, versioned, and integrated into an iterative data system, can capture gradual transformations in user profiles, providing structural support for projects aimed at behavioral change, progressive personalization, and evolving agent demands over time.

The model proposed in this research goes beyond merely representing users; it establishes a robust link between empirical analysis, technical-conceptual modeling, and design action, becoming a systemic resource for qualifying decision-making processes in design, engineering, and technological evaluation. The applicability of these profiles transcends static user description: it functions as a cross-validation mechanism, enabling the confrontation of constructs with the real profiles of their target users, assessing the maturity, usability, and responsiveness of the developed technological object.

4 CONCLUSION

This research presented the Structured and Advanced Model of Personas (MEAPs) as a novel methodological resource, guided by technical-scientific complexity and the growing need for personalization in interactions between agents and technological objects. Unlike traditional approaches, MEAPs articulates empirical data derived from structured analyses based on FCIA-OT, generating highly specialized, versionable profiles that are strategically applicable across diverse design cycles.

The constructed profiles operate as dynamic validation vectors, enabling not only the refinement of technological solutions but also the rigorous confrontation between constructs and the actual demands of their users. This articulation among evaluation, characterization, and modeling represents a significant conceptual and operational advancement, especially in scenarios requiring high responsiveness, inclusion, and continuous adaptability.

By establishing a rigorous link between empirical observation, multidimensional foundation, and practical application, MEAPs consolidates itself as a strategic tool for agent-centered design engineering. Its contribution transcends mere representation,

promoting an active system of knowledge, adaptation, and innovation capable of keeping pace with the evolution of usage contexts and anticipating emerging demands in technological development.

Given this analytical panorama, it becomes evident that the structure and outcomes of MEAPs not only address the gaps identified in the literature but also establish a new methodological standard for the technical and strategic representation of agents. These elements conclusively delineate the systemic value of the proposed model, which will be further consolidated in the next section.

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