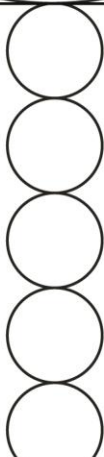
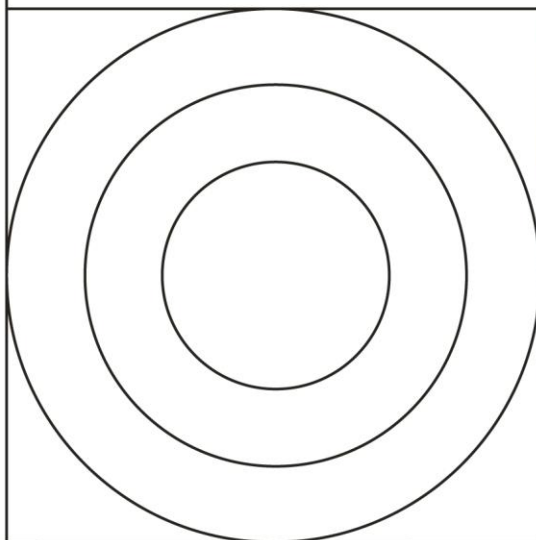
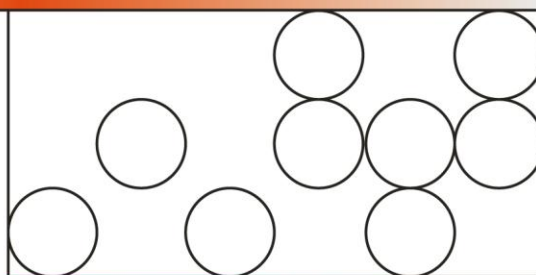
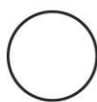


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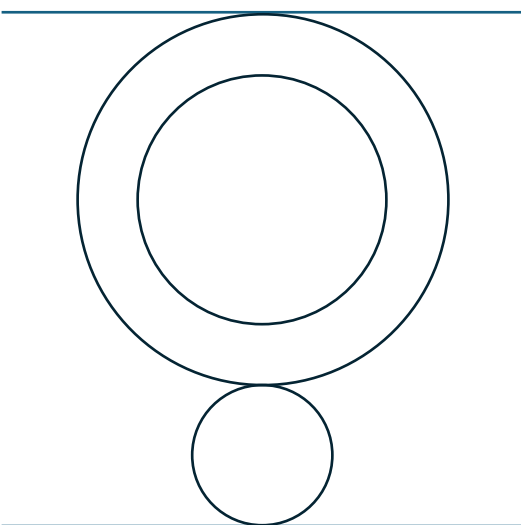
Conference
proceedings



Edited by

XXXVIII PhD Cycle in
Architecture and
Design Cultures

Alma Mater Studiorum
University of Bologna



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Editor:

Department of Architecture

Viale del Risorgimento, 2, 40136 Bologna BO

Edited by:

XXXVIII PhD Cycle in Architecture and Design Cultures -

Alma Mater Studiorum University of Bologna

Cover image © Università di Bologna

ISBN: 9788854972421

DOI: <https://doi.org/10.6092/unibo/amsacta/9087>

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[In]tangible

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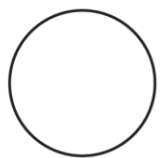
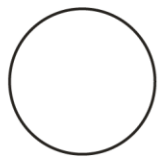
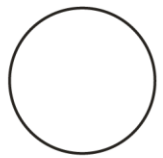
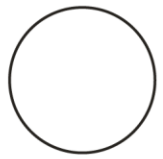
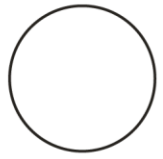
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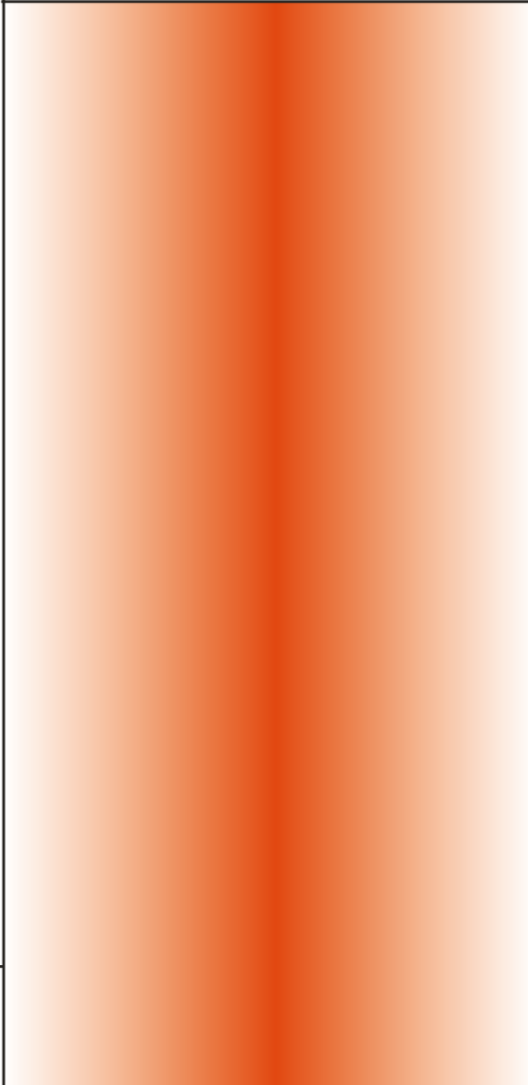
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[In]tangible interactions



[In]tangible interactions

In a historical context characterized by profound technological, social, and environmental transformations, the relationship between the tangible and intangible dimensions is gaining significance taking on an increasingly central role in design processes. Systems, services, and artifacts can no longer be interpreted exclusively as material or functional entities, but rather as components of hybrid ecosystems in which human, artificial, and environmental factors interact. In this scenario, design cultures are called upon to assume a critical mediating role, capable of making complex interactions legible, accessible, and negotiable. The [In]tangible Interaction track fits within this interpretative framework, offering itself as a space for interdisciplinary discussion on the changes taking place in the relationship between design and technology. In particular, the goal is investigating how contemporary design practices are increasingly oriented towards working with intangible elements, data, relationships, memories, behaviors, and experiences, without losing the connection with material, corporeal, and situated dimension of interaction. Exploring how design can contribute to the construction of more inclusive, accessible, and sustainable experiences, overcoming physical, cognitive, and cultural barriers, became one of the targets of this collection. The main objective is to investigate the role of design in the representation, and activation through enhancing the relationships between tangible and intangible, with particular attention to the impacts. Especially, this cluster investigates how contemporary design practices are increasingly oriented towards working with intangible elements, data, relationships, memories, behaviours, and experiences, without losing gaze of the material, physical, and situational dimensions of interaction. A second goal is represented by the delving on

how design can contribute to the creation of more inclusive, accessible, and sustainable experiences, overcoming physical, cognitive, and cultural barriers.

The contributions collected address the topic from different but converging perspectives, highlighting design as a cultural and operational infrastructure capable of translating complexity into understandable and participatory interaction systems. Researchers, designers, and technologists responded to the call for action by presenting theoretical studies, applied experiments, and critical reflections that interpret design as a device for mediation between people, data, and systems. In this sense, the discipline of design is understood not only as a practice of formalization, but as a process capable of orchestrating interactions between heterogeneous actors, human and non-human, and generating new forms of shared knowledge. This approach is particularly relevant in application areas such as cultural heritage, public services, inclusive mobility, data visualization, and the relationship between society and artificial intelligence. The contributions selected and presented in this section outline a complex panorama of research which, although operating on different scales and in different contexts, share a design-driven vision focused on the centrality of experience, social responsibility, and the construction of collective value. A first set of works addresses the theme of cultural heritage, both tangible and intangible, as a dynamic ecosystem of relationships. The original contributions dedicated to landscape, collective memory, and industrial know-how underline how design can operate as a tool for mapping, narrating, and activating distributed knowledge. In these studies, heritage is not understood as a static entity to be preserved, but as a living process, renewed through participatory practices and design devices capable of making often

invisible values like knowledge and identities, visible. In this case, the focus on the intangible dimension translates into methodological approaches that integrate field research, co-design, and digital tools, providing a systemic and situated knowledge overview.

A second thematic axis concerns the role of design in public services and systems, with particular reference to accessibility and inclusion. Contributions dedicated to Digital Twins, public services, and mobility for elderly or fragile populations show how technologies can become enablers of social innovation only if integrated within human-centered design frameworks. In these cases, design acts as a mediator between complex infrastructures, data, and citizens' needs, helping to translate abstract information into understandable interactions and to design experiences capable of reducing inequalities and barriers to access. considering that, focusing on tangible and intangible interactions allows the development of multi-level solutions, ranging from systems to services to products, while maintaining a design consistency oriented towards equity and sustainability.

Another conceptual core explores the relationship between data, their visualization, and derived behavioral change. Research on the representation highlight how the design of visual feedback can affect individual and collective attitudes, promoting more conscious and sustainable practices. In this sense, the intangible dimension of data is made perceptible through interfaces, dashboards, and that translate complex information into meaningful signals. Design emerges as a discipline capable of orchestrating such translations, taking into account cognitive, and social factors, demonstrating how interactions can become a lever for learning and transformation. Beyond the specific themes, the contributions to the track share some key elements that outline virtuous design approaches. First of

all, there is a strong focus on the participatory dimension of the project: users, communities, and stakeholders are not considered mere recipients of solutions, but active players in the processes of co-creation and evaluation. This orientation reinforces the role of design cultures as a relational practice, capable of building spaces for dialogue and negotiation. On the other hand, many contributions adopt a systemic perspective, recognizing the need to address complexity through multilevel and interdisciplinary models. Disciplinary mediation thus acts as a bridge between technical and social knowledge, capable of integrating advanced technologies, such as artificial intelligence, immersive systems, and digital platforms, within visions oriented towards the common good.

Finally, the sharpest outcome of this section highlights the potential of design to make the intangible aspects of experience visible and operational. Whether it is memory, data, behaviour, or relationships, the project action becomes a tool for translation and materialization, capable of transforming abstract elements into meaningful experiences. In this perspective, [In]tangible Interaction has established itself as a space for advanced reflection on the role of design in the future of interactions, helping to outline scenarios for a more inclusive, and sustainable society. At the same time, the variety and effort recordable in the collected contributions, confirm the need for more places where theoretical research and design experimentation can converge. Through design-driven approaches, the works presented show how design can operate effectively in the borderlands between tangible and intangible, offering critical and operational tools for addressing contemporary challenges. This cluster is not only a space for presenting research, but also a cultural platform for imagining and designing new forms of interaction between people, technologies, and environments.

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Tangible Interfaces for Intangible Experiences: the Role of the UX Specialist in the Software Development Team

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ABSTRACT

The term "technology" originates from the Greek words *téchnē* (art) and *lógos* (science), highlighting the link between creativity and scientific knowledge, which forms the basis for understanding the relationship between technology and design today. Technology is no longer just a set of tools; it is an ecosystem where both aesthetic and functional principles shape design. Design goes beyond the visible, influencing how individuals interact with technology, particularly on the Web, where interface design impacts the intangible element of User Experience (UX). This research explores the responsibilities of UX specialists within software design, showing how their expertise enhances web product development. A case study of an Italian hospital's web platform compares user satisfaction between two versions of the same interface - one developed with a UX specialist and one without - demonstrating the benefits of integrating UX expertise. The study highlights how incorporating usability and accessibility as core values in IT companies fosters both product quality and a collaborative, innovative culture, contributing to a more inclusive, user-focused future.

USER EXPERIENCE SPECIALIST | HUMAN CENTERED DESIGN | ACCESSIBILITY | USER SATISFACTION

1. Balancing function and form: the essential role of UX in digital design

In the rapidly evolving domain of digital technology, the relationship between design and technology has become increasingly pronounced. Technology is no longer merely a collection of tools or processes; it now constitutes an integrated ecosystem where experiences, interfaces, and products are shaped by principles that harmonize aesthetics and functionality. Design transcends the visible elements of objects or interfaces and encompasses the nuanced ways in which individuals engage with technology. This interplay is particularly evident in web-based contexts, where the tangible dimensions of user interface design significantly influence the intangible domain of user experience (UX). The importance of human-centered design lies in its capacity to address the persistent gap between user needs and developer outputs. This gap, often attributed to miscommunication and an inadequate understanding of user requirements, can compromise the success of digital projects. This highlights the critical role of designers in balancing functionality with aesthetics and of UX specialists in transforming implicit user needs into actionable design solutions.

Incorporating a preliminary design phase grounded in human-computer interaction principles generates substantial benefits throughout the lifecycle of digital services. Empirical evidence shows that software developers spend nearly half their time reworking tasks that could have been avoided, resulting in significant resource inefficiencies, particularly when errors are identified post-production (Ramdoo & Huzooree, 2015) (Aleryani, 2020).

This study, conducted in collaboration with an IT company, advocates for embedding accessibility and user satisfaction as fundamental values in corporate design practices, achieved through the systematic integration of UX specialists into organizational workflows.

The development of digital products involves distinct phases, including conception, design, development, and deployment, each of which presents unique challenges. These challenges become more complex when user input is not effectively incorporated during the initial stages of the process. This research argues that the early involvement of UX specialists provides a strategic response to these challenges by aligning user needs with technological possibilities. Their expertise allows for the identification of critical interaction details, minimizing errors and reducing the need for subsequent revisions. Rather than simply collecting requirements, UX specialists foster a comprehensive understanding of user expectations, ensuring their seamless integration into the design process.

Through a case study on the development of a web platform for an Italian hospital service, this research illustrates the transformative impact of involving UX specialists from the outset. A comparison of two interface versions, one developed with UX input and the other without it, demonstrates substantial improvements in user satisfaction, workflow efficiency, and error reduction. The findings also emphasize how usability and accessibility contribute to fostering a culture of

collaboration and innovation within IT organizations, ultimately enhancing both product quality and organizational practices.

In an era where technology permeates everyday life, designing user-centered digital solutions has become a necessity. This study contributes to academic discussions on the role of design in technological development, highlighting the importance of addressing user needs while promoting innovation, collaboration, and satisfaction within the digital industry.

2. Analyzing the design process: a case study of a hospital website

This research advances the discussion by presenting a case study centered on the analysis of a hospital web application developed by ManyDesigns, an Italian software company. The service, initially designed and implemented by a programmer, is analyzed in depth to identify areas for improvement. Following this analysis, an alternative solution is proposed and developed with the involvement of UX specialists and web designers. This new approach integrates principles of usability and web accessibility into the interface design.

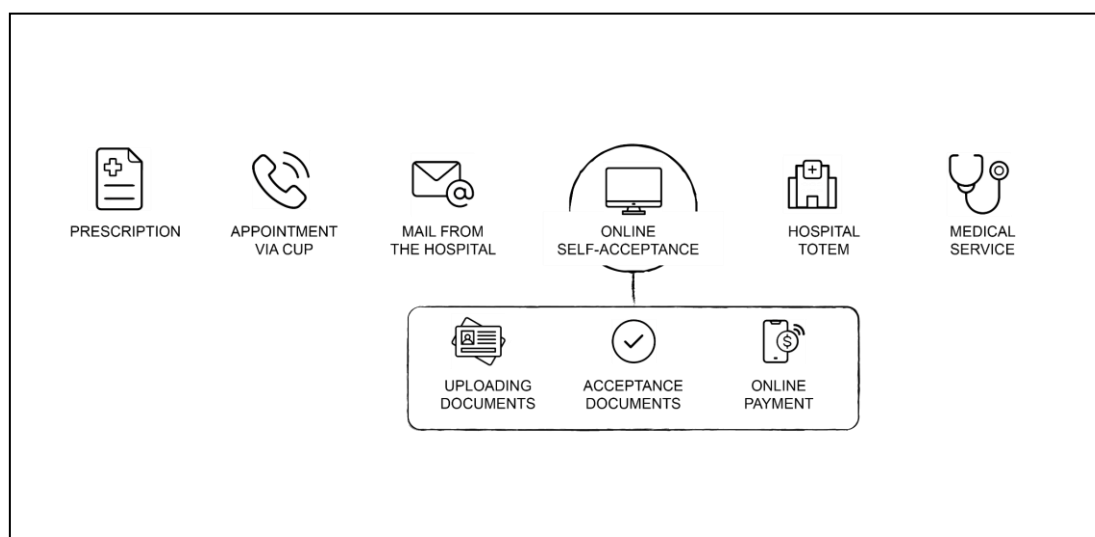
The next phase of the study involves user testing to assess preferences and determine which solution is perceived as more effective and satisfying. In addition to assessing user satisfaction, the research will look at wider impacts, including the social well-being of staff involved in the development process and the optimization of workflows. In particular, it investigates improvements in time and resource allocation and proposes a collaborative team model that improves efficiency and outcomes.

The service being studied, called Self-Acettazione (Self-Acceptance), addresses a critical need in the healthcare sector: streamlining and expediting access to medical facilities. By allowing insured patients to complete registration and payment for services remotely, the platform reduces queues at hospital counters, increases service efficiency and improves overall patient satisfaction.

Since its launch in July 2021, the Self-Acceptance platform has operated as part of a broader and more complex user journey [Fig. 1].

This journey typically starts with a doctor's prescription, continues with appointment booking through the central booking office (CUP), and culminates in the consultation or medical procedure. Within this framework, the Self-Acceptance service addresses the administrative phase of the patient journey, encompassing tasks such as submitting medical claims, registering patients, and processing payments for insured services.

Traditionally, these steps are performed in person at the hospital reception on the day of the appointment. By transitioning to a digital platform, the service seeks to streamline this process, enhancing efficiency and improving outcomes for both users and healthcare organizations.

**Fig. 1**

User journey illustrating the steps the patient follows to book a medical service through the Self-Acceptance service.

In addition, this study examines how adopting a UX-oriented approach fosters collaboration between designers and developers. This collaborative model not only enhances the quality of the digital solution but also contributes to the creation of more sustainable and human-centered technologies, aligning with broader goals of accessibility and inclusivity in the healthcare sector.

3. Exploring user needs: research activities and insights

The case study was analyzed through various user research activities: analytics, interviews, and expert analysis.

3.1 Analytics

A review of the analytical data from the platform's launch in July 2021 to November 2023 revealed a total of 172,130 processed performances, providing a substantial dataset for evaluating service efficacy and user behavior. The age distribution of users, ranging from infants to a 104-year-old, was analyzed due to its relevance in understanding the target audience. This analysis is essential for adapting the service's communication strategies and design to meet the needs of different age groups. Notably, the data identified a peak in usage around the age of 54, offering insights into key demographics for optimizing user engagement and service effectiveness [Fig. 2].

Upon classifying the users into age groups, with one group for those under 18 and another for those over 95, and dividing the intermediate ages into 10-year intervals, the most active user segments were found to be those between 46 and 65 years of age [Fig. 3].

The data analysis also provided a comprehensive overview of the overall success rate of the service. The data revealed a significant problem with both document upload and payment: only 15,053 users successfully uploaded the required documents (8.75%) and only 7,613 completed the required payments (4.42%). These results indicate the need to further investigate the barriers users face during the process in order to improve the service and increase completion rates.

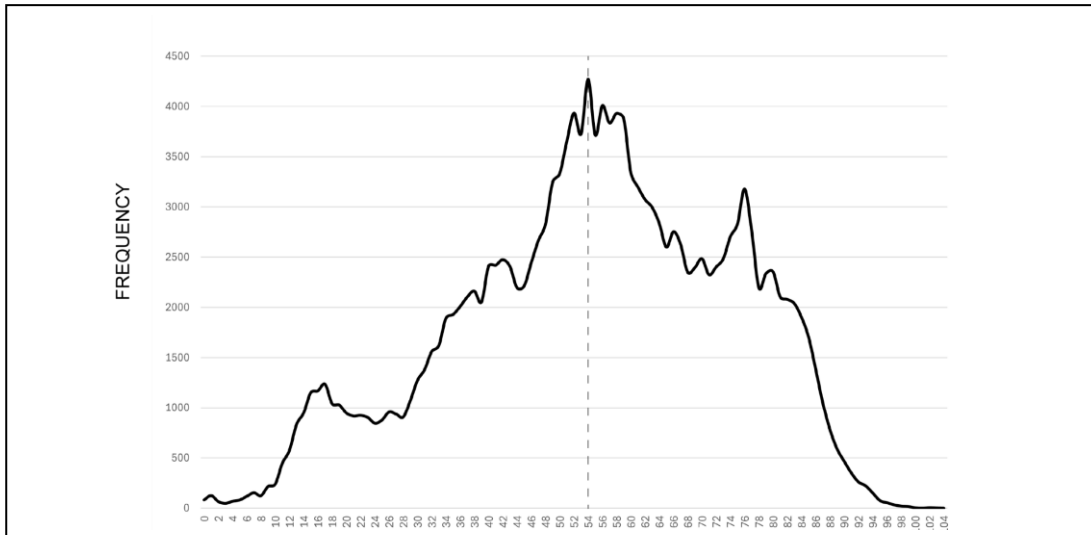


Fig. 2

The chart illustrates the number of interactions performed by users for each age, spanning from 0 to 104 years, with a peak in usage observed at the age of 54.

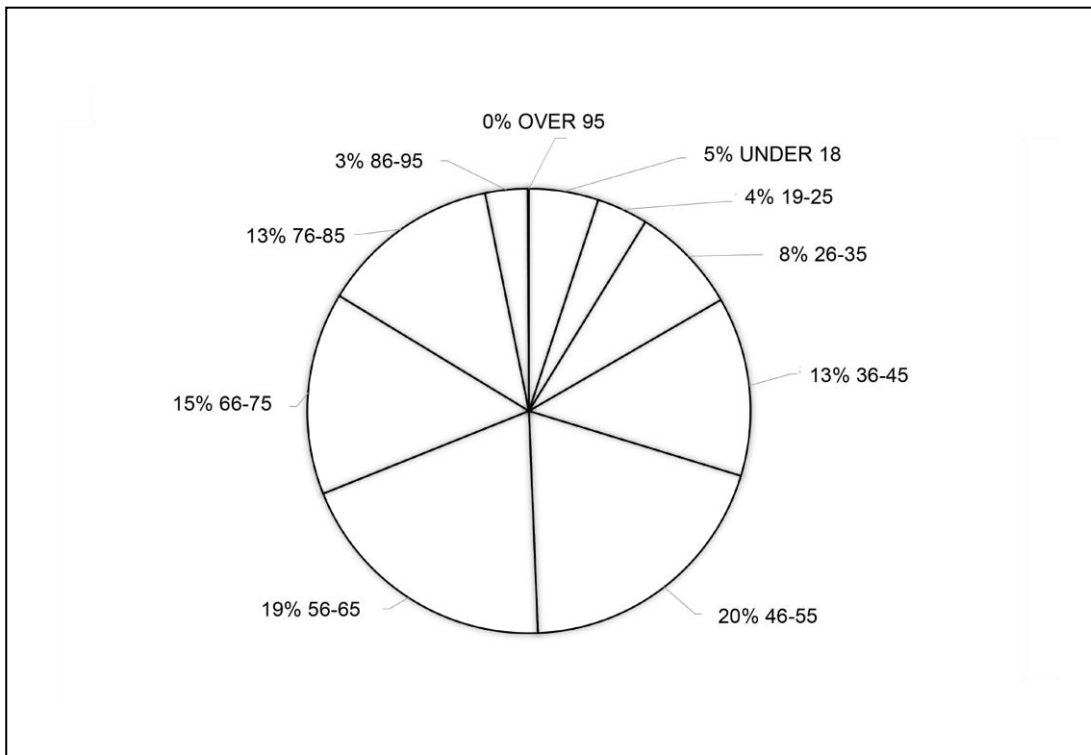


Fig. 3

The pie chart represents the percentage of interactions divided into different age groups, highlighting higher activity among users aged 46 to 65. Data is grouped into 10-year age ranges, with separate categories for users under 18 and over 95 years old.

3.2 Interviews

In order to gain a full understanding of the development process and the challenges encountered during the creation of the website, an anonymous interview was conducted in July 2024 with the developer responsible for the design and realization of the website. The aim was to explore the methods used in the development, the difficulties encountered and the organisational aspects of the work, from the initial concept to the final implementation. A number of key points about the development of the project emerged from the interview.

Firstly, the developer noted that although aware of the overall project objectives, there was limited communication with the client and access to strategic decisions made prior to the start of the project. This lack of direct interaction with business decision-makers may have contributed to the initial

specifications being unclear, compromising alignment with the client's real needs, which in turn affected both the timing and quality of the final product. The urgency to complete the project meant that the developer worked largely in isolation, with little opportunity for feedback or collaboration with more experienced colleagues or end users. This limited approach resulted in an initial product that fell short of expectations and required significant restructuring of the code to improve security, configurability, and management.

The visual design phase also suffered from limited resources, as the developer explained that the design was based on general guidelines rather than detailed mock-ups. This lack of clarity and visual consistency required further revisions, highlighting the importance of clearer initial documentation. Dissatisfaction with the outcome was expressed, with quality problems attributed to tight deadlines and a lack of timely feedback from a team of experts. A more collaborative management approach and additional time were suggested as factors that would have led to a better result. A significant issue raised was the lack of attention to accessibility and usability. The developer admitted a lack of knowledge of the Web Content Accessibility Guidelines (W3C, 2018), an area that represents a crucial opportunity for improvement. Compliance with accessibility standards is essential not only to ensure the inclusiveness of the website, but also to meet legal obligations, making it a priority for future improvements.

3.3 Expert Analysis

The final phase of the user research involved an expert evaluation of the current graphical user interfaces of the service to assess their usability and accessibility. The evaluation considered several parameters of the user interface and user experience, such as user flow, needs coherence, accessibility, service flexibility, layout and visual content hierarchy, visual consistency, interactivity and responsiveness, and finally aesthetics.

The analysis was carried out according to core UX design principles, web design guidelines and human-computer interaction concepts, including Jakob Nielsen's usability heuristics (Nielsen, 1993). The main problems identified were a lack of visibility of system status, an excess of redundant information and a non-intuitive visual hierarchy, which resulted in a sub-optimal user experience. In addition to the aforementioned interface issues, the lack of clear feedback and system information compartmentalized the user experience in terms of reliability and security. For example, the platform did not provide a confirmation email at the end of the process, which would have reassured users and provided a clear record of their actions. Furthermore, there were no clear instructions on what to do on the day of the visit, nor explicit information on the importance of using the service, with an effective communication strategy to convey the benefits of the platform.

4. Redesigning the user interface: a focus on usability and accessibility

Following a thorough analysis of the issues identified in the current version of the service, a redesigned set of interfaces was developed. This proposal was presented as mockups, prepared by

a web designer under the direction and supervision of a UX specialist. The redesign process utilized Adobe XD, which enabled detailed visualizations of the updated system architecture, simulations of navigation flows, and preliminary evaluations of user interactions to be produced before the development phase. These prototypes function as comprehensive visual references and essential tools for gathering feedback, supporting an iterative and user-centered design process.

The proposed improvements focus on simplifying and enhancing user communication, adopting a more accessible and reassuring language, and optimizing the reading flow to highlight key interface elements requiring user action.

For each stage of interaction, a comparative visualization is provided, with the current interface displayed on the left and the proposed interface on the right [Fig. 4-11].

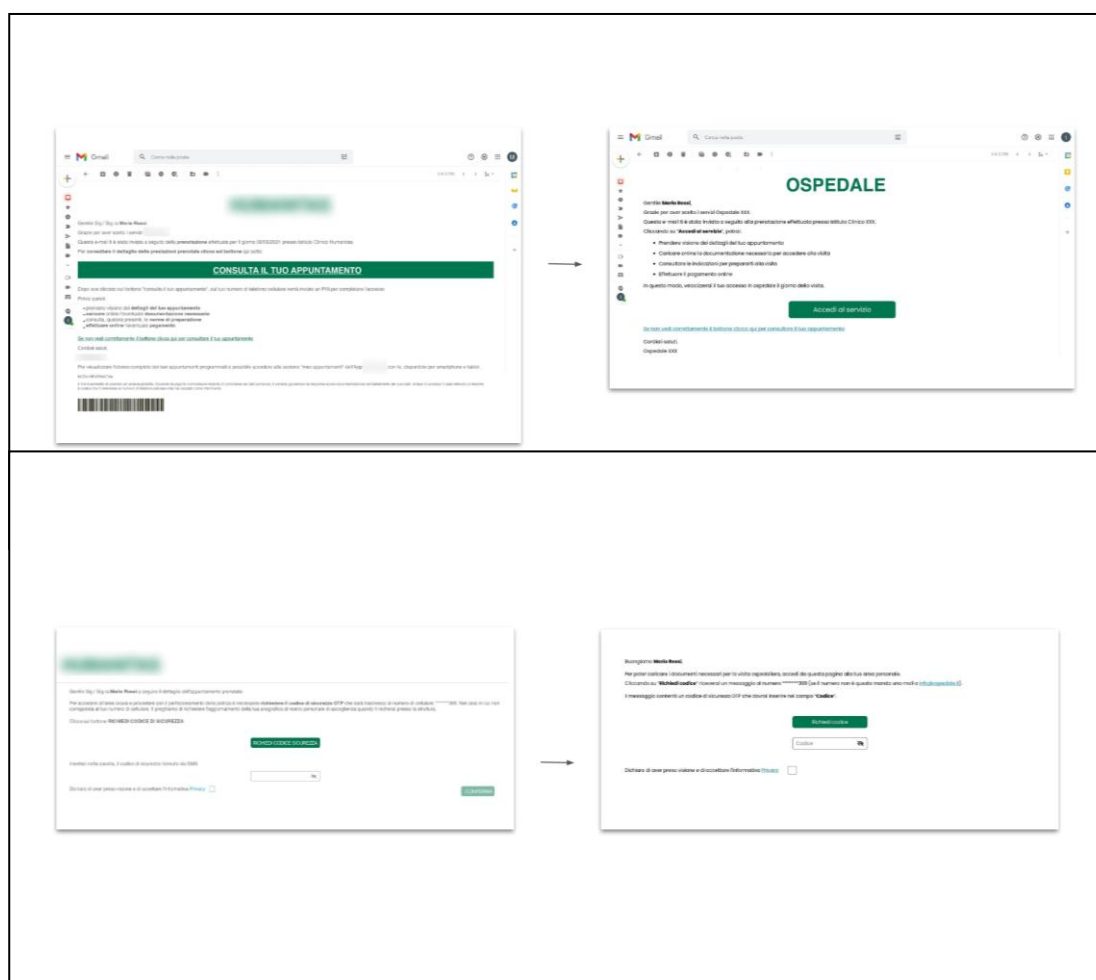


Fig. 4

Step 1: After scheduling the appointment, the user receives an email to access the service.

Fig. 5

Step 2: To access the secure area, the user must enter the code received via SMS.

OSPEDALE

Info visita

Prestito
ECOGRAFIA ADDOME SUPERIORE
Data: 10/05/2024 10:00
Orario visita: 10:00
Luogo: Ospedale XXX
Importo totale: 100,00 €
Importo a tuo carico: 100,00 €
Prenotamento appuntamento: 1

Documenti

Documenti richiesti sono necessari per la tua visita. Caricare la **Prescrizione medica** in tuo possesso. Selezionare il **Modulo di esenzione** e caricarlo separatamente (necessario per verificare la tua copertura assicurativa). Dopo aver caricato, clicca su "Verifica".

Prescrizione medica

1. Trovare il documento all'interno del tuo dispositivo
Clicca su "Carica"
2. Dopo aver caricato il documento clicca su "Verifica"

Modulo esenzione

1. Trovare il documento all'interno del tuo dispositivo
Clicca su "Carica"
2. Dopo aver caricato il documento clicca su "Verifica"

Pagamento

Fig. 6

Step 3: The user is provided with a summary of their booking. This screen prompts the user to download the necessary documentation for acceptance.

OSPEDALE

Info visita

Prestito
ECOGRAFIA ADDOME SUPERIORE
Data: 10/05/2024 10:00
Orario visita: 10:00
Luogo: Ospedale XXX
Importo totale: 100,00 €
Importo a tuo carico: 100,00 €
Prenotamento appuntamento: 1

Documenti

Documenti richiesti sono necessari per la tua visita. Caricare la **Prescrizione medica** in tuo possesso. Selezionare il **Modulo di esenzione** e caricarlo separatamente (necessario per verificare la tua copertura assicurativa). Dopo aver caricato, clicca su "Verifica".

Prescrizione medica

1. Trovare il documento all'interno del tuo dispositivo
Clicca su "Carica"
2. Dopo aver caricato il documento clicca su "Verifica"

Modulo esenzione

1. Trovare il documento all'interno del tuo dispositivo
Clicca su "Carica"
2. Dopo aver caricato il documento clicca su "Verifica"

Pagamento

Fig. 7

Step 4: After uploading the documents, the current interface does not allow the user to modify the file. The proposed interface, however, enables the user to review and confirm the accuracy of the uploaded file.

OSPEDALE

Info visita

Prestito
ECOGRAFIA ADDOME SUPERIORE
Data: 10/05/2024 10:00
Orario visita: 10:00
Luogo: Ospedale XXX
Importo totale: 100,00 €
Importo a tuo carico: 100,00 €
Prenotamento appuntamento: 1

Documenti

Documenti richiesti sono necessari per la tua visita. Caricare la **Prescrizione medica** in tuo possesso. Selezionare il **Modulo di esenzione** e caricarlo separatamente (necessario per verificare la tua copertura assicurativa). Dopo aver caricato, clicca su "Verifica".

Prescrizione medica

1. Trovare il documento all'interno del tuo dispositivo
Clicca su "Carica"
2. Dopo aver caricato il documento clicca su "Verifica"

Modulo esenzione

1. Trovare il documento all'interno del tuo dispositivo
Clicca su "Carica"
2. Dopo aver caricato il documento clicca su "Verifica"

Pagamento

Fig. 8

Step 5: After appropriately completing the PDF documents, the user must upload them to the platform. The user is then notified that they must wait a few days for the application to be validated.

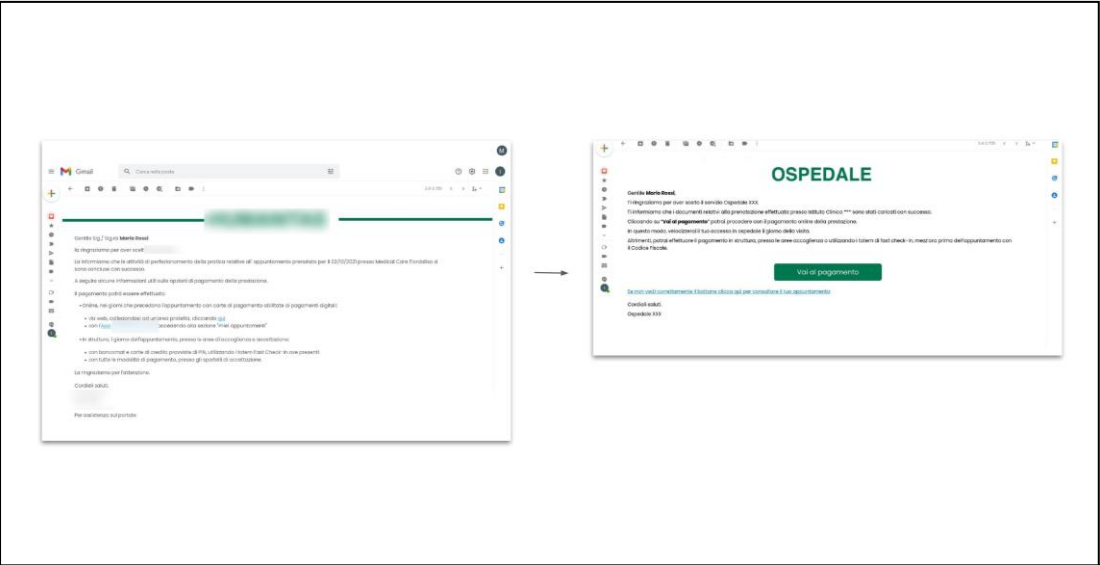


Fig. 9
Step 6: The user receives another email prompting them to proceed with the payment. This section is not analyzed here, as it falls outside the scope of the company and is managed externally.

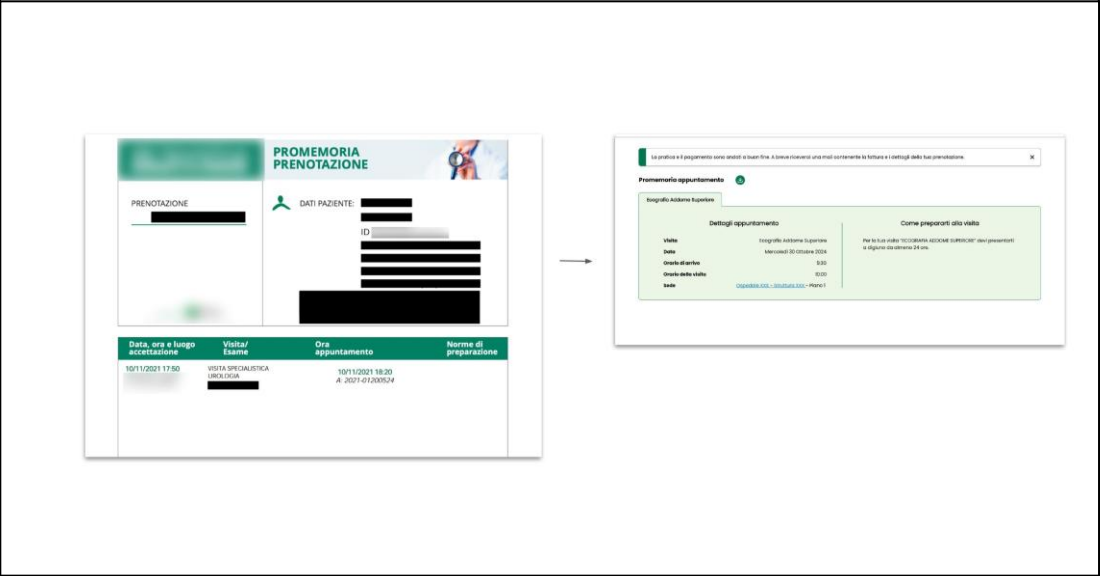


Fig. 10
Step 7: Once payment is completed, the user can view a summary of the application.

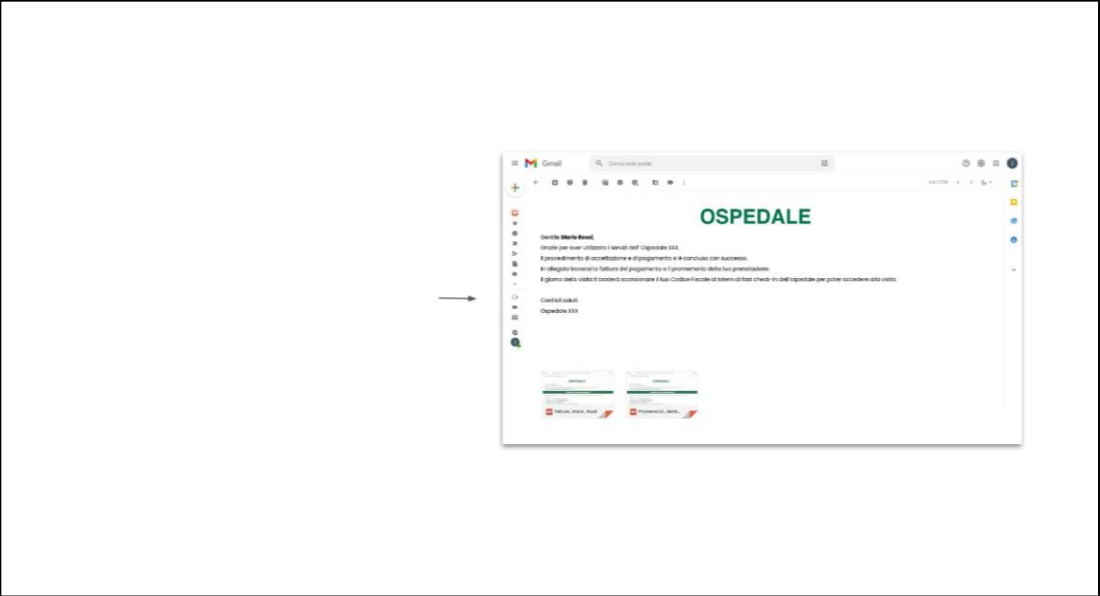


Fig. 11
Step 8: An additional communication summarizing the information for attending the appointment on the day of the visit has been implemented, which was not previously included.

5. Conclusions and future testing phases

The work detailed in this paper illustrates a comprehensive interface redesign process aimed at enhancing usability, accessibility, and overall user experience, alongside a refined workflow

implemented by the company to achieve these outcomes. By addressing critical pain points in the existing version and aligning with established design principles, the newly developed interfaces mark a significant step forward in improving service quality.

The next phase involves conducting an A/B test to compare the proposed interfaces with the current version. This evaluation will not only capture user preferences and satisfaction but also assess usability and interaction flow efficiency. Through a combination of quantitative metrics and qualitative feedback, the testing phase will provide actionable insights, guiding further refinements and ensuring the final implementation is both user-centric and functionally robust.

Key to the success of this process has been the adoption of mockup-level changes, which enabled faster iterations, reduced development time, and streamlined prototyping. This approach, combined with a clear division of roles within the team, ensured that each stage of the redesign benefited from specialized expertise, fostering collaboration and boosting productivity. The efficient handover between design and development teams further enhanced the quality and smoothness of the workflow.

Looking ahead, this methodology will extend beyond the Self-Acceptance project, serving as the foundation for upcoming initiatives. By integrating UX specialists into IT teams from the outset and moving away from direct code-based workflows, the company is embracing a more structured and effective design approach. This shift not only underscores the importance of user-centered design but also demonstrates its potential to elevate the efficiency and impact of software development projects.

Acknowledgments

I would like to thank ManyDesigns Srl for making this research possible. Their support and active collaboration significantly contributed to the planning of the activities described.

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