

Springer Series in Design and Innovation 24

Nuno Martins
Daniel Brandão
Francisco Paiva *Editors*

Perspectives on Design and Digital Communication III

Research, Innovations and Best Practices

 Springer

Springer Series in Design and Innovation

Volume 24

Editor-in-Chief

Francesca Tosi, University of Florence, Florence, Italy


Series Editors

Claudio Germak, Politecnico di Torino, Turin, Italy

Francesco Zurlo, Politecnico di Milano, Milan, Italy

Zhi Jinyi, Southwest Jiaotong University, Chengdu, China

Marilaine Pozzatti Amadori, Universidade Federal de Santa Maria,
Santa Maria, Rio Grande do Sul, Brazil

Maurizio Caon , University of Applied Sciences and Arts, Fribourg, Switzerland

Springer Series in Design and Innovation (SSDI) publishes books on innovation and the latest developments in the fields of Product Design, Interior Design and Communication Design, with particular emphasis on technological and formal innovation, and on the application of digital technologies and new materials. The series explores all aspects of design, e.g. Human-Centered Design/User Experience, Service Design, and Design Thinking, which provide transversal and innovative approaches oriented on the involvement of people throughout the design development process. In addition, it covers emerging areas of research that may represent essential opportunities for economic and social development.

In fields ranging from the humanities to engineering and architecture, design is increasingly being recognized as a key means of bringing ideas to the market by transforming them into user-friendly and appealing products or services. Moreover, it provides a variety of methodologies, tools and techniques that can be used at different stages of the innovation process to enhance the value of new products and services.

The series' scope includes monographs, professional books, advanced textbooks, selected contributions from specialized conferences and workshops, and outstanding Ph.D. theses.

The volumes of the series are single-blind peer-reviewed.

Keywords: Product and System Innovation; Product design; Interior design; Communication Design; Human-Centered Design/User Experience; Service Design; Design Thinking; Digital Innovation; Innovation of Materials.

How to submit proposals

Proposals must include: title, keywords, presentation (max 10,000 characters), table of contents, chapter abstracts, editors'/authors' CV.

In case of proceedings, chairmen/editors are requested to submit the link to conference website (incl. relevant information such as committee members, topics, key dates, keynote speakers, information about the reviewing process, etc.), and approx. number of papers.

Proposals must be sent to: series editor Prof. Francesca Tosi (francesca.tosi@unifi.it) and/or publishing editor Mr. Pierpaolo Riva (pierpaolo.riva@springer.com).

Nuno Martins · Daniel Brandão · Francisco Paiva
Editors

Perspectives on Design and Digital Communication III

Research, Innovations and Best Practices

 Springer

Editors

Nuno Martins
Research Institute for Design, Media
and Culture, School of Design
Polytechnic Institute of Cávado and Ave
Barcelos, Portugal

Daniel Brandão
Communication and Society Research
Centre, Institute of Social Sciences
University of Minho
Braga, Portugal

Francisco Paiva
Labcom, University of Beira Interior
Covilhã, Portugal

ISSN 2661-8184

ISSN 2661-8192 (electronic)

Springer Series in Design and Innovation

ISBN 978-3-031-06808-9

ISBN 978-3-031-06809-6 (eBook)

<https://doi.org/10.1007/978-3-031-06809-6>

© The Editor(s) (if applicable) and The Author(s), under exclusive license to Springer Nature Switzerland AG 2023

This work is subject to copyright. All rights are solely and exclusively licensed by the Publisher, whether the whole or part of the material is concerned, specifically the rights of translation, reprinting, reuse of illustrations, recitation, broadcasting, reproduction on microfilms or in any other physical way, and transmission or information storage and retrieval, electronic adaptation, computer software, or by similar or dissimilar methodology now known or hereafter developed.

The use of general descriptive names, registered names, trademarks, service marks, etc. in this publication does not imply, even in the absence of a specific statement, that such names are exempt from the relevant protective laws and regulations and therefore free for general use.

The publisher, the authors, and the editors are safe to assume that the advice and information in this book are believed to be true and accurate at the date of publication. Neither the publisher nor the authors or the editors give a warranty, expressed or implied, with respect to the material contained herein or for any errors or omissions that may have been made. The publisher remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

This Springer imprint is published by the registered company Springer Nature Switzerland AG
The registered company address is: Gewerbestrasse 11, 6330 Cham, Switzerland

Scientific Committee

Ana Catarina Silva, Escola Superior de Design IPCA (PT)
Andreia Sousa, Universidade Lusófona do Porto (PT)
Catarina Lelis, University of West London (UK)
Cátia Rijo, Escola Superior de Educação IPL (PT)
Cláudia Lima, Universidade Lusófona do Porto (PT)
Daniel Brandão, Universidade do Minho (PT)
Daniel Raposo, Politécnico Castelo Branco (PT)
Eliana Penedos, Politécnico Leiria (PT)
Fernando Moreira da Silva, Faculdade de Arquitetura da Universidade de Lisboa (PT)
Fernando Suarez Carballo, Universidad Pontificia de Salamanca (ES)
João Alves de Sousa, Universidade Lusófona do Porto (PT)
Karel van der Waarde, Swinburne University of Technology, Melbourne (AU)
Leonardo Pereira, Universidade de Aveiro (PT)
Mario Buono, University of Campania (IT)
Marta Fernandes, Politécnico do Porto (PT)
Nuno Coelho, Universidade de Coimbra (PT)
Nuno Martins, Escola Superior de Design IPCA (PT)
Pedro Amado, Universidade do Porto (PT)
Pedro Cardoso, Universidade de Aveiro (UA)
Ricardo Melo, Fraunhofer Portugal AICOS (PT)
Rui Rodrigues, ESMAD-IPP (PT)
Sérgio Dominique, Escola Superior de Hotelaria e Turismo IPCA (PT)
Vítor Quelhas, ESMAD-IPP (PT)
Cristina Sylla, Universidade do Minho (PT)
Francisco Paiva, Universidade da Beira Interior (PT)

Preface

This book responds to the dimension of “anticipation” described as one of the dimensions of Design for Innovation by [1]. It aims at highlighting the social and civilizational responsibility of design and to describe how this is being carried out at multiple levels and in line with the priority established by the European Union in 2014, in the so-called agenda for Responsible Research and Innovation (RRI). The agenda gave a great focus to design for all, and to guidelines to achieve this, and was based on the recommendations by the European Design Leadership Board [2], in the report “Design for Growth and Prosperity.” The report identified six strategic areas for design: European Design on a Global Stage; Design in Europe’s Innovation System; Design in Europe’s Enterprises; Design in Europe’s Public Sector; Design in Europe’s Research System, and Design in Europe’s Education System.

In line with this paradigm, we also consider the four dimensions of design for innovation scalped by Stilgoe and Guston (2017): Anticipation, Reflexivity, Inclusion, and Responsiveness. They are expected to converge with the emerging transition design approach, which is being developed worldwide in multiple contexts, such as within the Carnegie Mellon [3] and the Great Transition Initiative (Peter 19 Sterling, February 2016 and <https://www.greattransition.org/>) [4].

This book aims at depicting the multifaceted nature of design according to the paradigms and trends explained above, offering a timely snapshot of the diverse approaches to design and a picture of the transition that this discipline has been experiencing. It offers extensive information and cutting-edge ideas for understanding the kind of service that design is currently providing and will be able to provide to the society, on a broad, transdisciplinary basis. It also features the type of ecosystem innovation design is fostering, taking into account the four key areas of the transition design framework: transition vision, theories of change, mindset and posture, and new ways of designing [3].

In time of crisis, such as the present one, design can offer important answer to societal challenges imposed by complex and ambiguous phenomena, such as climate change, resource depletion, instability due to wars and massive migrations, and pandemics, among others. The ubiquitous presence of digital and multimedia contents, the sensible role that communication and the creation and dissemination

of narratives has in contemporary societies, the needs of improved and inclusive interfaces for human–machine interaction, as well as the growing importance of concepts such as visualization and representation, may benefit both from a stronger participation of designers, and awareness of design concepts, in different disciplinary fields (software development, urban development, education, and so on).

The main research directions in design and digital communication are reflected by the organization of this book into five thematic parts, namely:

1. User-centered digital design;
2. Research methods and strategies;
3. Pedagogy, society, and design practice;
4. Digital design branding; and
5. From design history to its transdisciplinarity.

In all of them, theory and practice are inextricably intertwined.

This book gathers original contributions written by renowned researchers and professionals. They consist of revised and extended contributions to the 5th International Conference on Digital Design and Communication (Digicom 2021), held in November 4–6, 2021, in Barcelos, Portugal. It also includes additional chapters by important international researchers who were invited to present the most relevant outcomes of their current research projects. The chapters were subjected to a rigorous evaluation by both the editors and the scientific committee of Digicom. They address and seek to inspire both researchers and practitioners in the broad field of design and communication, by covering the following main topics:

- Challenges of digital interaction and communication;
- Between the utility and the dilemmas of digital design applications;
- Design for digital literacy and social inclusion;
- Design and digital communication in times of crisis;
- Information design toward design activism;
- Designing visual identities and branding given the vicissitudes of hypermodernity;
- Designing cultural heritage in the face of digital transformations.

Barcelos, Portugal
Braga, Portugal
Covilhã, Portugal

Nuno Martins
Daniel Brandão
Francisco Paiva

References

1. Stilgoe J, Guston DH (2017) Responsible research and innovation. In: Felt U et al (eds) *Handbook of science and technology studies*, 4th edn. MIT Press, Cambridge, MA, pp 853–880
2. Koskinen T, Thomson M (eds) (2014) European Commission, Directorate-General for Enterprise and Industry, *Design for growth & prosperity: report and recommendations of the European Design Leadership Board*, Publications Office. <https://data.europa.eu/doi/10.2769/52223>
3. Irwin T (2015) Transition design: a proposal for a new area of design practice, study, and research. *Des Cult* 7(2):229–246. [10.1080/17547075.2015.1051829](https://doi.org/10.1080/17547075.2015.1051829)
4. Sterling P (2016) Why we consume: neural design and sustainability. Great transition initiative. <http://www.greattransition.org/publication/why-we-consume>

Contents

User-Centered Digital Design

**Interfaces, Data and Plural Languages to Develop CoDE:
A Collaborative Platform for Multidisciplinary Teams** 3
Michela Carlomagno

**Scratch-Based Game Development Resource Set for a Toolkit
to Game Design** 19
Pedro Beça, Sofia Ribeiro, Mónica Aresta, Rita Santos,
and Ana Isabel Veloso

**Preventing Wildfires from Our Phones: A Communitarian
Participation Mobile App to the Portuguese Context** 31
Manuel Gil, Liliana Gonçalves, and Lídia Oliveira

**Design and Development of an Online Sales Platform for the Brand:
Engenharia Do Brigadeiro** 53
Viviana Maia, Leonardo Pereira, and Daniel Brandão

**Protecting Users' Information and Dignity Through
Privacy-Enhancing Design** 69
Davide M. Parrilli and Rodrigo Hernández-Ramírez

Research Methods and Strategies

**Design Radicalized as Experience: Disentangling and Reassembling
the Dance Floor Experience to Understand the Relationship
Between Design and Clubbing** 91
César Lugo-Elías and Pedro Cardoso

**A Case Study of Remote User Research with Older Adults During
Lockdown: Analysis of Barriers, Strategies and of Communication
Issues** 105
Ricardo Araújo, Ana Vasconcelos, and Ana Correia de Barros

Digital Security Narratives in the Time of COVID-19: A Case for Kindness 123
Lizzie Coles-Kemp and Peter A. Hall

The Professional Practice of Type Designers in the Design of Variable Fonts 137
Maíra Woloszyn and Berenice Santos Gonçalves

Pedagogy, Society and Design Practice

Inclusive Design is Much More Than the Opposite of Exclusive Design 157
Fernando Moreira da Silva

Sci-Stories in Design: Guidelines for Curricular Inscription and Dissemination Through Visual Narratives 167
Eliana Penedos-Santiago, Susana Barreto, Cláudia Lima, Rui Vitorino Santos, Nuno Martins, and Pedro Amado

Designing for People with Dementia in Academic Contexts 181
Cláudia Lima

How Design and Technology Can Contribute to Learning: The Mobeybou in Brazil Educational Game Case Study 195
Rafael Fernandes, Cristina Sylla, Nuno Martins, and Maitê Gil

Hermeneutic Methodology to Design the Skin of the City 211
Liliana Soares and Ermanno Aparo

Visactivism: A Conceptual Model to Identify Information Visualization as an Expression of Design Activism 223
Pedro Duarte de Almeida

Digital Design Branding

Capitalist Visuality: Branding, Architecture, and Its Visual Reproduction. A Case Study in the City of Porto 241
Ana Miriam Rebelo, Heitor Alvelos, and Álvaro Domingues

A Sense of Kyoto Through Advertising: A Case Study on How Outdoor Advertising Can Support Local Identity 255
Ana Seixosa and Maria Cadarso

Brand Management: From Storytelling to Strategic Narratives 275
Sérgio Dominique-Ferreira, Sofia Praça, and Catherine Prentice

Dynamic Visual Identities: Reflection on Interaction and Playfulness in Visual Identity Design by Porto Design Studios 297
Rita Coelho and Suzana Dias

Developing an Integrated Communication Plan in the Digital Age 313
 André Teixeira, Sergio Dominique-Ferreira, Nuno Martins,
 and Cristina Sylla

From Design History to Its Transdisciplinarity

Multisensory Fruition Between Cultural Heritage and Digital Transformation 329
 Mario Buono, Sonia Capece, Camelia Chivăran, Salvatore Gerbino,
 Giovanna Giugliano, Alessandro Greco, Elena Laudante,
 Maria Laura Nappi, and Ciro Scognamiglio

Mapping Ecosystems Through Design—Reflections of the DesignOBS Project 357
 Nina Costa, Rui Costa, Afonso Borges, Vasco Branco,
 António Modesto, Raul Cunca, and Ana Catarina Silva

Growing Knowledge Across Boundaries: Lessons from a Multi-Actor Design Project 375
 Alison Burrows, Filipe Lima, Ricardo Pessoa, Rui José,
 and Paula Trigueiros

Design in a Post-pandemic Era 393
 Francisco Paiva

Mediated Authorships: The Designer as the Instructor of Machines 401
 Luis Ortega and Julia Capomaggi

User-Centered Digital Design

Interfaces, Data and Plural Languages to Develop CoDE: A Collaborative Platform for Multidisciplinary Teams



Michela Carlomagno 

Abstract The essay aims to investigate the contemporary communicative languages introduced by the design culture for the development of digital platforms and interfaces. The research starts by analysing the state of the art regarding the creation of digital networks and the increasing diffusion of alternative means of communication, which is facilitated by the use of digital media and online tools able to amplify the geographical limits of relationships. Nowadays, collaborative digital tools and platforms are assuming an essential role in the dissemination of knowledge and information, through the creation of digital archives and databases; as facilitators of relationships for remote collaboration, through the definition of workspaces, to be used asynchronously and synchronously, with the consequent reduction of spatial and temporal boundaries. This diffusion has led visual communication design to explore and define alternative languages, made up of codes and visual synthesis, to design complex visualisations and facilitate communication within digital spaces. Starting from these considerations, the research defines a collaborative platform denominated CoDE that aims to facilitate interaction within multidisciplinary groups. The final part of the paper illustrates the GUI and UX elements of the platform and identifies their potential and future developments.

Keywords Digital platform · User interface · Collaborative design

1 Introduction

In the current digital era, the Internet is not only a space for interaction and sharing of data, information and documents, but also a “tool for connecting people, thoughts, contexts and spaces beyond the sense of place” [1]. We are witnessing an extension where relationships are free from the traditional constraints of time and space and in which it is not necessary to share the moment of interaction. There is “the union

M. Carlomagno (✉)

University of Campania “Luigi Vanvitelli”, 81031 Aversa, CE, Italy

e-mail: michela.carlomagno@unicampania.it

of the social experience of our real-life with cyber-space, thus creating a new hybrid social space” [2, p. 16].

The World Wide Web and Information and Communication Technologies (ICT) have contributed to this radical transformation of interpersonal relations and ways in which people communicate, also accentuated by behavioural changes and new lifestyles adopted in the Covid-19 pandemic.

The ways of working and studying remotely have changed physical spaces configuration but also the work modalities and tools, able to satisfy new needs and specific purposes compared to the traditional ones. Online activities have grown significantly with the spread of smart-working and e-learning models used by many companies, enterprises and institutions. Networked connectivity and workspaces evolution have also influenced the design and the way designers interact and collaborate with stakeholders, users and communities. In Design fields, the widespread multidisciplinary, interdisciplinary and transdisciplinary approaches [3, 4] have involved an increasing number of disciplines and stakeholders within the project, giving rise to new needs such as the sharing of languages, the equal collaboration between actors involved, avoiding role imbalances during the project phases and actively involving all parties involved. Therefore, traditional tools, used during design activities, such as cards, toolkits, games and physical objects, are replaced by digital platforms that connect people at a distance and record information, by offering personalized functionalities for the design and management of teamwork activities.

Digital spaces become actual places where connect, interact and exchange knowledge but also spaces for accessing data and content, mediated by the spread of digital interfaces and platforms. In these spaces, collaborative whiteboards and dashboards are intended as places to work and share tasks and information, organise files and resources, and design using templates, post-its and mindmaps. On the one hand, this promotes the possibility to establish global connections between people, stakeholders and whole communities, by transferring large amounts of data and making network communication effective. On the other hand, the risk of information overload and incorrect data manipulation affects the ability to interact within the project team, generating misunderstandings and gaps between stakeholders involved.

The chapter presents the first results of a doctoral research that starts with the study of the evolution of interfaces as virtual spaces of interaction and the selection of digital platforms used both as workspaces and tools to design and share ideas and as places to collect data and information to be transferred immediately through the construction of complex narrations and visual synthesis. The analysis of the strengths and weaknesses of the platforms and the identification of the needs of inter- multidisciplinary teams at work have led to the definition of the digital tool parameters and functionalities, described in the last paragraph of the essay.

The digital tool consists of a platform able to support the collaboration of teams composed of heterogeneous disciplines and skills, by creating a common language, identifying competence gaps, tracking activities and deadlines, and constantly visualising information flows and ideas.

2 The Evolution of Interfaces as Virtual Spaces of Interaction

The evolution of *information forms* and the necessity to create new relations between user and computer have allowed Design to experiment with new user experiences and to define new ways of using contents and interaction spaces through the definition of interfaces. Currently, fields close to Interaction Design and Human–computer Interaction (HCI), such as User Experience Design [5], Service Design and Information Design, experiment with interfaces and new experiences able to involve and generate digital networks, that are places of access, exchange and comparison.

In these areas, visual communication tools, such as infographics and graphic visualisations, take the role of storytellers and make the information explicit in visual syntheses that facilitate data access and decoding, and support the transfer of content within digital platforms. As defined by [6, p. 5] “Information Visualization is the use of computer-supported, interactive, visual representations of abstract data to amplify cognition”.

The development of interfaces and platforms combine aspects that concern the user (such as predispositions, expectations, needs, behaviours) with the features of the designed system (usability, purpose, adaptability, functionality) and the cyberspace (or environment) in which the interaction takes place to define new interactions with products and services.

In contemporary society, physical and digital spaces are linked to create “cognitive communities”—that is communities that dialogue and collaborate on a project through the digital network in which temporary goals and ideas are shared. Indeed, communication and interaction modalities between people are changed, mediated by screens and digital devices. Communication becomes electronic and the language “electrified” [7], capable of transferring information flows and therefore cognitive content within the new media. In this context of hyper-connection, the use of wearable devices such as watches, glasses and clothing, is transforming also the ability of interfaces to react to external factors and human input through voice, gesture and haptic controls, creating a link to the physical dimension and sometimes overlapping it.

The spread of ICT and new media have contributed to shape these changes, leading to the current software society [8]—driven by technological progress and “connective thinking”. Digital space is no longer just a space of vision and action, but a space of interaction with information and remotely connected individuals [7, 9]. Interfaces become a medium in which news, stories, knowledge and thus culture can be transferred [10, 11]. As [12] states, “digital interfaces assume the role of translating and processing cultural products into bits and then returning them in understandable forms to humans, according to shared cognitive schemas” [13]. This has also influenced the definition of digital networks of experts, where products and services are defined by the collaboration of different actors who actively participate in the definition of the project.

Consequently, the interface has become a mediator not only between human-computer and human-platform but also as a process of communication between people and of monitoring the different activities. This has shifted the design focus from how users interact with objects, to the use of new visual languages inside the Web to transfer messages and contents. In this paradigm shift, interface as mediator become a technique for thought: an “allegorical device” that makes the social world accessible in an age of information, through levels or layers. As [14] claims “an interface is not a thing, an interface is always an effect. It is always a process or a translation” (p. 33).

3 Plural Languages for the Infographic Project

In the contemporary *infosphere* [15], communication inside media becomes interactive, allowing the transfer of information through interfaces that facilitate cross-media exchange. We are moving towards a “simulation, or interface, culture” that interacts with IT tools to explore virtual worlds, through manipulation and rewriting of iconic text, shaped on the screen according to our mental connections. New media and information systems, in general, enable this manipulation and transcoding of information transforming data into digital open, accessible and modifiable languages [12].

The electronic screen is intended as an extension of the human mind, where the linguistic and cultural forms of new media become the result of a merging of the computer logic and the cultural level of media content. In this scenario, communication design can translate comparisons and dialogues into design opportunities, make new scenarios visible, help to address common challenges, act sustainably and identify complex action strategies.

Graphic symbols and visual representations facilitate access to information through diagrams, maps, pictograms, icons and templates for the development of the interfaces. The use of grids and layouts allows information to be hierarchized, make it readable and accessible to others by creating visual, textual and verbal languages.

Visual syntheses within the platforms facilitate the exploration and definition of new forms of sharing, driven by open processes and the ability and desire to explore ideas and design proposals, investigate, experiment and consider multiple perspectives and potential solutions to create complex visualisations. Interfaces have become a means of connecting different actors, mediators with which we can explore alternative worlds and use information dynamically and interactively using narrations, and places in which to collect data and decode them openly. Even the design project is no longer the result of the individual action but that of a group of stakeholders with different skills, approaches and jargon adopted during the various phases of design process. The digital space becomes the place where synthesise these differences and experiment with new ways of collaboration and participation.

The cultural sites where the digital and the physical meet is also the key subject of *info-aesthetics*. But rather than think only in terms of convergence, as a cultural historian of

the present I am also thinking about other relationships: those of conflict, contradiction, borrowing, hybridization, remix. [16, p. 8]

4 New Needs and Narrative Artifacts in the Digital Era

Digital tools and services, which have emerged in the last 10 years, have facilitated the need to dialogue and share information at a distance, communicate immediately, collaborate in the creation of project proposals in a visual way and participate constantly in the creative process through shared spaces, diagrams and maps for the visualisation of contents and ideas [17].

Digitisation, open access and the consequent possibility of using large quantities of data have facilitated the dissemination and experimentation of tools for reading and decoding information. These tools are based on self-organized systems and the creation and transfer of common knowledge by carrying out co-design, co-creation and participatory design approaches.

The necessity to transmit and share content and knowledge has produced a series of communicative artefacts, including virtual ones, static or dynamic/interactive, to which the use and access to contents are associated, through new forms of narration and visualization such as digital storytelling, data storytelling or data visualization.

Numerous researchers from Tufte to Cairo have questioned how to shape data, starting from the stages of collection, analysis and visualisation to the identification of techniques to communicate in a clear, reliable and understandable way [18–20]. As Giorgia Lupi states: “In its second wave, data visualization will inevitably be all about personalization. The more ubiquitous data becomes, the more we need to experiment with how to make it unique, contextual, intimate. The way we visualize it is crucial because it is the key to translating numbers into what they really stand for: knowledge, behaviors, people.” [21].

Indeed, new data-driven applications require the interaction of the user/reader, involving and helping them to understand the content communicated in a personalised way. Reference [18] in “The Functional Art” focuses not only on the purely aesthetic aspect of visualisations but also highlights the need to achieve an aesthetic that serves the purpose. A “functional beauty” that aims to make a visual representation not only attractive but able to influence the way the user perceives and explores data.

Beauty and functionality are interconnected, or should be. Beautiful and intriguing objects improve our mood and predispose us to be patient when it comes time to learn how to use them. [18, p. 92]

Data visualisation design, over time, has inspired new forms of narrations, changing the storytelling and the reading of contents through participatory and open methods for collecting and visualising digital information. New spaces of investigation and access are being experienced, as well as operational tools such as storytelling and interactive platforms, which support the reading of information, making it accessible to a large number of people. Storytelling [22] is used to give a form and meaning to intangible elements such as the bits that compose data, transforming them into

information and thus into knowledge. In particular, the construction of codes, visual artefacts and languages, and alternative usability formats, such as graphic visualisations, which permit the reading of information, help to make the content usable and readable [23] within the platform.

In the last 10 years, the spread of digital collaboration tools such as *Miro*, *Milanote*,¹ *Slack*,² and *Figma*,³ have allowed people to work remotely, share ideas and project proposals through platforms, facilitation tools and visual synthesis [24]. Other interactive platforms have used digital visualization and storytelling, guided by codes and pictograms, to display stories and large amounts of data synthetically. These tools aim to facilitate interaction and information by making it amplifiable and interactive and to immerse the user in digital experiences.

Platforms such as “The Shape of Dreams”, designed by Federica Fragapane and “Publishing Peninsula Talks” made by Accurat Studio, allow users to explore stories/information through a multi-level navigation system, guided by graphic elements and visual codes. “Rebound” by the MIT Senseable City Lab and “Atlas of Emotion”, on the other hand, make it possible to read databases through the use of filters, legends and interactive maps that simplify information management.

These examples of platforms have in common the use of multilevel visualisations and graphical forms of communication such as data visualization and data storytelling, that allow not only to explore and read information but also to involve and simplify the processes of data gathering and storage using diagrams, texts, animations and colours. All these elements contribute to the creation of languages and forms of visual representation that make the user experience in digital platforms customisable. Shared modalities of usage are experienced to translate inputs from different contexts into diagram-based visual models [25] that facilitate the creation of connections and enable collective planning, through “bridge-artefacts” [23] that help build visual languages. “Bridge-artefacts” are visual languages useful “to connect different points of view, local contingencies and multiple interests, structural features of a complex social system (...) for the representation of smooth and complex spaces, spaces of knowledge and controversy.” [23, p. 4]. Graphs, or charts, used in visualizations take on different configurations according to objectives and visual characteristics, such as bar charts, diagrams, histograms, radar charts or word-clouds useful for comparing data, visualizing temporal sequences, categorizing and classifying information or correlating multiple elements by highlighting relationships and hierarchies [26].

¹ *Miro* and *Milanote* are digital workspaces in which is possible to share the workspace visually to design asynchronous or real-time and personalize the creative process with templates. For more information visit the link <https://miro.com/> and <https://milanote.com/>.

² *Slack* is a project management tools, in which teams can communicate and collaborate in a virtual space working remotely, managing and organizing activities by timeline. For more information visit the link <https://slack.com/intl/it-it/>.

³ *Figma*, is a collaborative whiteboards in which visual collaboration allows teams to design together by translating the design process into a real project through sketches and animated prototypes. For more information visit the link <https://www.figma.com/>.

5 Development of the Collaborative Digital Platform: Parameters, Functionalities and Languages

The project presented starts from the definition of the background up to field research composed of one-to-one interviews and online surveys, which allowed to recognise tools, approaches and behaviours used by actors involved in multidisciplinary teams and identify common needs and issues such as the necessity to adopt a common language, to share information constantly and to update and personalize the design process according to the issue. In particular, the analysis of the weaknesses and opportunities of the mediation tools has allowed defining parameters and functionalities to develop a digital tool able to support the collaboration within groups composed of different stakeholders and from various contexts and to reduce the spatial and temporal boundaries.

The use of visual communication forms such as storytelling, diagrams and graphical elements contributed to the configuration of the Graphical User Interface (GUI). The aspects required for the elaboration of the interface are usability, clarity of information, accessibility, simplicity and user-friendliness. The GUI is developed by combining visual elements—colours, graphical signs, pictograms and charts—and textual content lists, thematic clusters of words, keywords—which define the graphical appearance and functions through buttons, drop-down lists, navigation and search areas and charts. Diagrams allow the exploration of information interactively and are part of the design of the graphical interface. The use of simple shapes, outlines and pictograms allows information to be read and conveyed and enables immediate interaction, harmonising language differences [27] and promoting constant interaction.

From these premises, the research focused on digital tool development, able to support collaboration within multidisciplinary groups, facilitating the sharing of languages, project proposals and ideas and establishing equal interaction. The platform named CoDE (Collaborative Design Ecosystem) is an open digital space that aims to facilitate interaction and knowledge transfer. It consists of an open and collaborative platform that guides multidisciplinary groups in the team-building phases, the organization of project activities, the construction of a common language, and the visualization of the archetypes that will guide to the final solutions. It is realized according to a design process that starts from the definition of functionalities, the collection of information in a database up to developing diagrammatic systems that facilitate constant access to the team's information and simplify the collaboration between parties. The process is organised and divided into 5 phases:

1. identification of parameters, characteristics and functionalities, starting from the background analysis and the data collection activity;
2. building of the database carried out through a process of analysis and coding;
3. definition of the Graphical User Interface (GUI), starting from the identification of visual languages, codes and diagrams able to facilitate interaction;
4. digitisation of the functionalities and definition of the platform prototype;

- 5. testing of the interface effectiveness and criticalities through a pilot study with the reference target.

The parameters defined for the development of the tool’s functionalities are: visualisation, customisation, sharing and variability, in order to support collaborative, visual, dynamic and interactive design.

Visualization is the parameter capable of showing inputs of information in graphical diagrams, from the visualization of the team composition to the identification of the skills involved and gaps useful with the aim to optimize the team. The elements related to this parameter are determined according to disciplines, project fields and themes placed in the database.

Customization is the parameter that can configure graphic diagrams, maps and work timelines on varying inputs, to implement teams with new skills during the project development. The elements related to this parameter are determined according to the choices of the team members concerning the contents of the tool.

Variability is the parameter that makes the information editable by the team and consequently set the graphical visualizations related to the tool functionalities. The elements related to this parameter are determined according to the codes and data entered in the database.

Sharing is the parameter that builds a repository of elements on which the team finds feedback and approves, contents, forms, references, results and timing. The elements related to this parameter are based on information entered in the platform that flows into an open and implementable archive.

The four parameters guide the flowchart design, organizing the layout of the platform and its contents, through the subdivision of layers of information and visualizations that respond to the features and contents organized in the database. The platform layout is illustrated through the description of the main interface pages (see Figs. 1 and 2).

The first window of the homepage, is the introductory section of registration and access to information, with tabs for sign-in and log-in and user/team profile

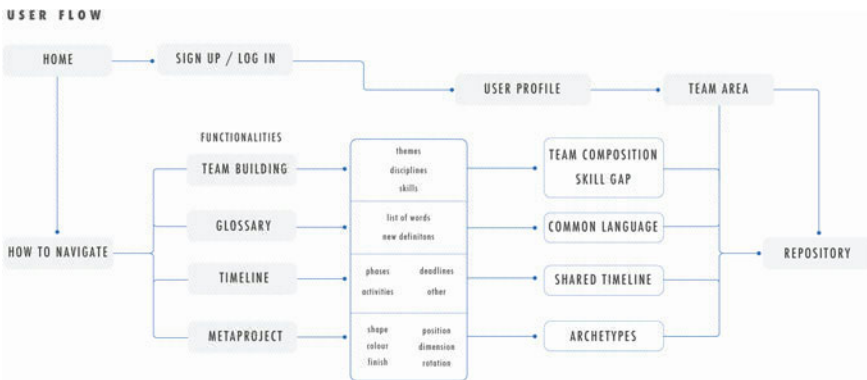


Fig. 1 User flow and UX elements definition for the platform development

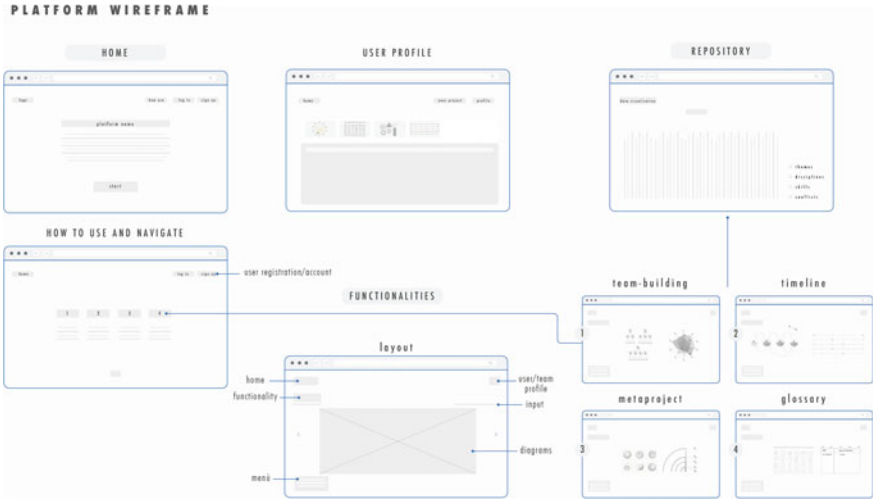


Fig. 2 Platform wireframe with the homepage, the user profile, how-to-navigate section and the four functionalities layout

management. Moreover, in the first pages is possible to explore the instructions (how to navigate), understand the purpose of each function and start the collaboration work (see Fig. 3). The opening windows facilitate the visualization and consultation of information, in synchronous or asynchronous mode, by all members of the group. The next sections are related to the navigation of four functionalities: team-building, timeline, glossary and meta-project, described in detail below. All features are linked to the home page and to the user profile section where all the information selected during the navigation are recorded. The four main functionalities are connected to the categories of elements and information to be selected by all team members.

5.1 Team-Building

The team-building represents the first functionality, able to support the composition of the multidisciplinary working group by suggesting the skills needed in the design process, distinguished by areas and themes and to detect any skills gaps related to the disciplines involved and those to be included in the team. It includes the identification of the themes, disciplines and skills involved in the team, to visualize the competence layers and identify a wider reference skill set for the team construction.

It consists of a section in which to build the team, through the choice of themes, disciplines and skills involved. The layout of the navigation menu, located at the bottom left, indicates the paths to access the three subcategories—themes, disciplines, skills and the next function. The information entered into the platform is collected in the reference database and is displayed, within the tabs, in synthetic



Fig. 3 Platform windows with the homepage, the registration section, the user profile and the four functionalities: team-building, timeline, glossary and meta-project

diagrams that facilitate the choice and selection by the user. This section enables the first phase of synergistic and equal collaboration, offering the possibility to visualize and identify any gaps in disciplines and skills within the multidisciplinary team, through the use of screens and systems of overlays and interactive visualization menus (see Fig. 4).



Fig. 4 Teambuilding functionality with the selection of themes, disciplines and skills of the team

5.2 Glossary

The glossary supports the construction of a common vocabulary through a lexical database implementable with definitions related to words, concepts, and technical terms most used by the different actors of the team during the project process. It consists of the construction of a glossary useful for sharing a common language within teams, through implementable definitions. It represents the space in which to consult the definitions identified in the reference database and aims to facilitate the sharing of a common language.

For this function, a second section dedicated to the implementation of the glossary (add new definition) has been prepared. A space in which to identify new technical terms and definitions that characterize the different disciplines involved in the team and that can create misunderstandings in their use, for the divergence of meanings they assume in different areas and disciplinary contexts (see Fig. 5).

5.3 Timeline

The timeline functionality facilitates the definition of the sequence of process phases, agreeing on the expected results for each step, roles and deadlines. Moreover, it allows for the management of objectives, the visualization and planning of activities of all

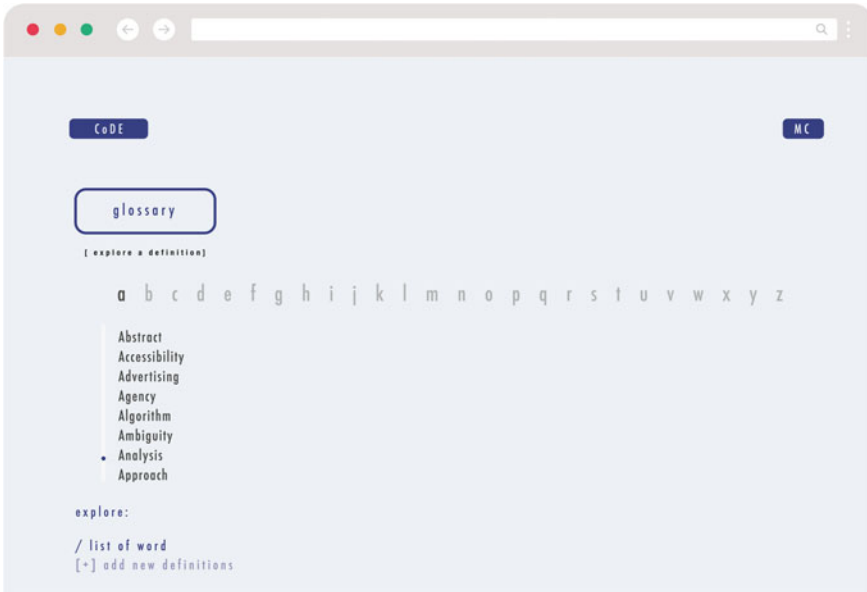


Fig. 5 Glossary functionality with the list of words and the section to add new definitions

team members. It consists of the set-up of a space dedicated to the organization of work phases, activities and deadlines guided by a code characterized by pictograms that allow the construction and customization of a chronological sequence related to the project. The purpose of this functionality is to organize the project process, identify activities, phases and deadlines, by generating a calendar of meetings and visualize the level of interaction of the actors involved and how the disciplines intervene in the work phases.

It is composed of a timeline and a series of pictograms differentiated by shape and colour that lead to the customization of your process by identifying and calendaring—phases, activities, deadlines or meetings and others—in order to organize and track the activities of the team and share term and goals for projects realization (see Fig. 6).

5.4 Meta-Project

The meta-project functionality drives to visualize ideas through shapes, modifiable through algorithms, and lets aggregate elements to synthetically represent ideas during all the creative process phases. It is a system of shapes, colours and elements guided by parameters and algorithms that allow the composition of elements, useful for the visualization of the proposals in the meta-project. An abacus of forms and codes, accessible to all team members, which allows the construction and sharing of



Fig. 6 Timeline functionality with the timeline to personalize with phases, activities, deadlines and others

archetypes. This functionality represents a virtual interaction space, useful to stimulate the ideation phase in the teamwork and support the conceptualization of the project idea to visually synthesize the purposes that emerged in the analytical phase.

This section is composed of the predisposition of basic shapes divided in solid, outline and intersection and by inputs and parametric variables such as shape, colour, dimension, surface finish, rotation and position on the plane. The parametric code is defined in Grasshopper, a language and visual programming environment that runs within the Rhinoceros 3D CAD software. The algorithm allows the overlapping and the configuration of the different basic elements between them, translating the creative process in a shared visualization of geometric shapes, determined by the interaction between user and digital tool and by the relationship between shapes and codes that generate a representative archetype of each team member (see Fig. 7).

The interface allows users, members of the team, to interact collaboratively and immediately, at the same time, collects and classify data in a repository to make information available to other groups and allowed to explore them on multiple levels. Following the graphic definition of the platform screens, a first interactive digital prototype was defined and tested on focus groups with samples similar to the target audience to verify the clarity of the graphic interface, the functionalities and to implement the user experience and flow.



Fig. 7 Meta-project functionality with the exploration of shapes and the composition of digital archetypes

6 Conclusions and Future Steps

The aspects investigated in this article are some of the possibilities offered today by the digital platforms for the management of systems of relationships generated by the collaboration between different actors and how these systems are influenced by external factors. The use of communicative codes and graphical synthesis in digital spaces allows spreading of information and knowledge, adopting interactive, visual and multilevel languages able to involve people.

The platform intends to experiment with a new model of multidisciplinary collaboration able to reduce the disparities that are generated within the teams, through the use of communication codes, and visual synthesis that allows a constant exchange and interaction between the actors involved.

The realization of digital space, flexible and open, able to record inputs allowed to define a model of collaboration and active participation in the project, through customizable and interactive features and to facilitate the exchange of knowledge and languages through an implementable repository. CoDE help to track activities, visualize skills and have constant access to the team information, by facilitating the management of phases and activities, activating a continuous comparison and participation of different actors through interaction and experimentation of visual codes.

The graphical user interface of the platform was tested in several focus group sessions, each composed of 3–4 participants, to test the user flow, functionalities and graphical elements of the platform by using the “Think aloud protocol” on the interactive prototype defined in Adobe Xd software. This led to the collection of initial feedback and improvement of the graphic interface layout and user flow. In the near future, further tests with new samples will be carried out to implement the GUI and to analyze new needs for the definition of new functionalities for the platform CoDE. The experimentation with multidisciplinary, interdisciplinary and transdisciplinary groups at work during the creative process will allow the identification of other factors which hinder remote collaboration, misunderstandings and conflicts negatively affecting the success of projects. The final step is the creation of the website to launch the tool online and implement the platform database with new information and data.

References

1. Buffardi A (2011) Introduzione, pp 1–6. In Buffardi A, de Kerckhove D (2011) *Il sapere digitale. Pensiero ipertestuale e conoscenza connettiva*. Liguori, Napoli
2. Riva G (2010) *I social network*. Il Mulino, Bologna
3. Marzocca F (2014) *Il nuovo approccio scientifico verso la transdisciplinarietà*. In Átopon. Rivista di psicoantropologia simbolica. Mythos Edizioni, Roma
4. Nicolescu B (2006) Transdisciplinary, past, present and future. In: Haverkort B, Reijntjes C (eds) *Moving worldviews—reshaping sciences, policies and practices for endogenous sustainable development*. Compas Editions Leusden, Netherlands, pp 142–166
5. Hassenzahl M (2010) Experience design: technology for all the right reasons. *Synth Lect Human-Centered Inf* 3(1):1–95
6. Card SK, Mackinlay JD, Shneiderman B (1999) *Readings in information visualization: using vision to think*. Morgan Kaufmann Publishers, San Francisco
7. de Kerckhove D (2011) *Il pensiero ipertestuale. Sensorialità terziaria e processi cognitivi in Rete*, pp 27–45. In Buffardi A, de Kerckhove D (2011) *Il sapere digitale. Pensiero ipertestuale e conoscenza connettiva*. Liguori, Napoli
8. Manovich L (2010) *Software culture*. Edizioni Olivares, Milano
9. Buffardi A, de Kerckhove D (2011) *Il sapere digitale. Pensiero ipertestuale e conoscenza connettiva*. Liguori, Napoli
10. Anceschi G (ed) (1993) *Il Progetto delle interfacce. Oggetti colloquiali e protesi virtuali*. 1a ed. Domus academy, Milano
11. Bonsiepe G (1995) *Dall’oggetto all’interfaccia: mutazioni del design*. Feltrinelli, Milano
12. Manovich L (2001) *Il linguaggio dei nuovi media*. Olivares, Milano
13. Buffardi A (2011) *Il pensiero ipertestuale. Sensorialità terziaria e processi cognitivi in Rete*, pp 27–45. In Buffardi A, de Kerckhove D (2011) *Il sapere digitale. Pensiero ipertestuale e conoscenza connettiva*. Liguori, Napoli
14. Galloway A (2012) *The interface effect*. Polity Press, Cambridge
15. Floridi L (2012) *La rivoluzione dell’informazione*. Codice Edizioni, Torino
16. Manovich L (2008) *Introduction to info-aesthetics*. Available online <http://manovich.net/content/04-projects/060-introduction-to-info-aesthetics/57-article-2008.pdf>. Last accessed 21 Feb 2022
17. Manovich L (2011) What is visualization? *Vis Stud* 26(1):36–49
18. Cairo A (2013) *L’arte funzionale. Infografica e visualizzazione delle informazioni*. Pearson, Milano-Torino

19. Lima M (2011) *Visual complexity: mapping patterns of information*. Princeton Architectural Press, New York
20. Pometti M, Tissoni F (2018) *Comunicare con i dati. L'informazione tra data journalism e data visualization*. Ledizioni, Milano
21. Lupi G (2017) *Data humanism: the revolutionary future of data visualization*. Available at link: <https://www.printmag.com/article/data-humanism-future-of-data-visualization/>. Last accessed 26 Feb 2022
22. Ferraro G (2020) *Teorie della narrazione. Dai racconti tradizionali all'odierno storytelling*. Carocci Editore, Roma
23. Ricci D (2008) *Nei tre segni. Diagrammi per la Complessità e le controversie*. Density Design
24. Carlomagno M (2022) *Fluid collaborations digital platforms to support creative communities*. In: Martins N, Brandão D (eds) *Advances in design and digital communication II. DIGICOM 2021*. Springer series in design and innovation, vol 19. Springer, Cham
25. Scagnetti G, Ricci D (2007) *Diagrammi generativi (Generative diagrams)*. *Linea Grafica, International review of graphic design and visual communication*, n. 370, July/August, pp 58–65. Available at link: https://issuu.com/densitydesign/docs/diagrammi_generativi_-_generative_diagrams/6
26. IBM (2021) *Data visualization*. Available at link: <https://www.ibm.com/design/language/data-visualization/overview>. Last accessed 28 Feb 2022
27. Vossoughian N (2011) *Otto Neurath. The language of the global polis*, 2nd edn. NAI/D.A.P. Distributed Art Publishers
28. Byung-chul H (2022) *Le non cose: Come abbiamo smesso di vivere il reale*. Einaudi, Torino
29. Johnson S (1997) *Interface culture: how new technology transforms the way we create and communicate*. Harper, San Francisco

Scratch-Based Game Development Resource Set for a Toolkit to Game Design



Pedro Beça , Sofia Ribeiro , Mónica Aresta , Rita Santos ,
and Ana Isabel Veloso 

Abstract Games are engaging activities for students that can be applied in classes worldwide. Simultaneously, toolkit's potential has been rising over the years due to its ability to encompass relevant tools on specific subjects. Moreover, toolkits can be applied as authoring tools transforming students into game designers, motivating the creation of digital and/or mobile games, and knowledge acquisition and engagement. The Gamers4Nature (G4N) project has been researching on environmental-themed games' development, involving students in game development sessions. Aiming to support the whole game design process for upper-secondary and undergraduate education, the G4N project conceived a Toolkit to Game Design that has been used in formal and informal contexts of education fostering the creation of digital games on environmental themes. The G4N Toolkit, addressing both experienced and novice students, was design in a User-Centered approach with iterative sessions for validating aesthetics and contents. As it was understood that students sometimes lacked the skills to develop their games, preventing them to accomplish a finished product, a complement to the already produced resources (Game Construction cards, Rapid Game Design Document, environmental-themed cards, and Mobile Game Design Guidelines), was developed: the Development Cards Set. This chapter introduces the Development Cards Set creation process, to be validated through expert review (by experts in the game development field) and by end-users who will test and validate the development cards along dedicated workshops and game creation sessions.

P. Beça (✉) · S. Ribeiro · M. Aresta · R. Santos · A. I. Veloso
Department of Communication and Art, University of Aveiro, Aveiro, Portugal
e-mail: pedrobeca@ua.pt

S. Ribeiro
e-mail: saribeiro@ua.pt

M. Aresta
e-mail: m.aresta@ua.pt

R. Santos
e-mail: rita.santos@ua.pt

A. I. Veloso
e-mail: aiv@ua.pt