



# Preliminary Results from a Systematic Literature Review on Enaction and Embodiment in Interactive Installations

*Emanuel Felipe Duarte*      *Yusseli Lizeth Méndez Mendoza*  
*Maria Jêscá Nobre de Queiroz*      *M. Cecília C. Baranauskas*

Technical Report - IC-21-01 - Relatório Técnico  
February - 2021 - Fevereiro

UNIVERSIDADE ESTADUAL DE CAMPINAS  
INSTITUTO DE COMPUTAÇÃO

The contents of this report are the sole responsibility of the authors.  
O conteúdo deste relatório é de única responsabilidade dos autores.

# Preliminary Results from a Systematic Literature Review on Enaction and Embodiment in Interactive Installations

Emanuel Felipe Duarte\*      Yusseli Lizeth Méndez Mendoza\*  
Maria Jêsa Nobre de Queiroz\*      M. Cecília C. Baranauskas\*

## Abstract

This technical report presents preliminary results of the museum research scenario that were achieved during the fourth year of the Socioenactive Systems project (São Paulo Research Foundation Thematic Project, FAPESP #2015/16528-0). In this report, we first briefly introduce the context of the Socioenactive Systems project, then, we present preliminary results from a systematic literature review on enaction and embodiment in interactive installations. The methodology of the review is thoroughly described with details about research questions, inclusion and exclusion criteria, search strategy, description of study characteristics and quality and relevance assessment. As preliminary results, we present an overview of the 80 selected documents regarding when and where were they published, by who, what was the application context, how was evaluation treated, and their calculated quality and relevance for our review. We briefly discuss our findings and some of their implications for the Socioenactive Systems project and the museum scenario. Finally, we close the report with our concluding remarks and some directions intended for the following year.

## 1 Introduction

Not a long time ago computer use was limited to performing tasks that were well defined and most often spatially confined to individual workspaces. Today, digital technologies are present in many areas of our lives and are used for a variety of purposes at all times, everywhere, and by many people. This evolving role of computational technology in human life is in alignment with the concept of ubiquitous computing as proposed by Weiser [16]. These technologies, however, are not entirely “invisible” in the sense proposed by Weiser, as they still largely rely on goal-oriented interaction models and the traditional Graphical User Interfaces (GUI) input and output methods through a mouse, keyboard, and (touch)screen. As an alternative to more transparent interaction, the work of Kaipainen *et al.* [9], with their so-called “enactive systems”, hints towards the idea of human and computer not as separate systems, but as a “coupling” between the human being and the computational technology. Their premise, inspired by the seminal work of Varela, Thompson, and Rosch [15], is that interactions are *embodied*, *i.e.*, guided by the body’s involvement and the human agent’s spatial presence. An enactive system, as proposed, can detect both deliberate and non-deliberate information from the body (*e.g.*, movement or physiological readings) and respond accordingly. This, in turn, generates a response in the person, and the enactive cycle goes on.

Although valuable in its originality, there is one important limitation in Kaipainen *et al.*’s [9] enactive system concept: it is ultimately a one-person experience. This limitation, in turn, presents the opportunity of expanding the concept of enactive systems to something that also takes

---

\*Institute of Computing, University of Campinas (UNICAMP), Campinas-SP, Brazil

the social dimension into account. In this regard, this work is part of a thematic project called “Socio-Enactive systems: Investigating New Dimensions in the Design of Interaction Mediated by Information and Communication Technologies”. The project is funded by the São Paulo Research Foundation (FAPESP) through grant #2015/16528-0. For the sake of simplicity, in this technical report, we will refer to this project simply as the “Socioenactive Systems project”. The Socioenactive Systems project foresees three scenarios of experimentation: educational (school), healthcare (hospital), and artistic and scientific (museum). All three scenarios share the same goal of expanding the concept of enactive systems, by adding the social element to it. The adopted methodology for the construction of the Socioenactive Systems project is the set of semio-participatory techniques [1] built upon methods and artifacts from Organizational Semiotics (OS) [10, 2].

This technical report describes the activities conducted in the museum scenario during the year 2020, which was the fourth year of the Socioenactive Systems project (for 2019, see [5], for 2018, see [7], and 2017 see [6]). In this report, we will focus on presenting the process and preliminary results of a systematic literature review conducted in the context of the museum scenario. The objective of the literature review is to investigate how concepts such as enaction, socioenaction, and embodiment, in conjunction with ubiquitous and/or pervasive technologies, have been used in the context of interactive installations and exhibition environments, such as museums and other public spaces. The reason that this technical report focuses only on the process and preliminary results is that more complete analyses and discussions will be featured in forthcoming publications planned for journals and conference proceedings.

This technical report is organized in the following manner: in Section 2 we present the methodology for the systematic literature review, including details for each conducted step. In Section 3 we present preliminary results, including an overview of the selected documents along with visualizations of relevant data extracted from these documents. In Section 4 we briefly discuss our preliminary results and their importance within the museum scenario and the Socioenactive Systems project. Finally, in Section 5 we present our main conclusions and directions for the next steps.

## 2 Methodology

In this systematic literature review, we followed a process based on the one proposed by Gough, Oliver, and Thomas [8]. This process, illustrated in Figure 1, started with defining the review team composed by the four authors of this technical report and defining the research objective of investigating how concepts such as enaction, socioenaction, and embodiment, in conjunction with ubiquitous and/or pervasive technologies, have been used in the context of interactive installations and exhibition environments. The process is then followed by the definition of a set of research questions and a protocol, presented in Section 2.1; the formulation and conduction of a search strategy, presented in Section 2.2; a description of the studies’ characteristics, presented in Section 2.3; an assessment of the quality and relevance of the selected studies, presented in Section 2.4; a synthesis, preliminarily presented in Section 4, and finally reporting. The synthesis is only presented preliminarily because it is a work in progress to appear in future publications. Reporting, in turn, is this technical report itself and other forthcoming publications derived from this work.

### 2.1 Research Questions & Protocol

We defined the following research questions to guide our systematic literature review:

RQ1: How technology-based interactive installations and exhibitions spaces (museums and other

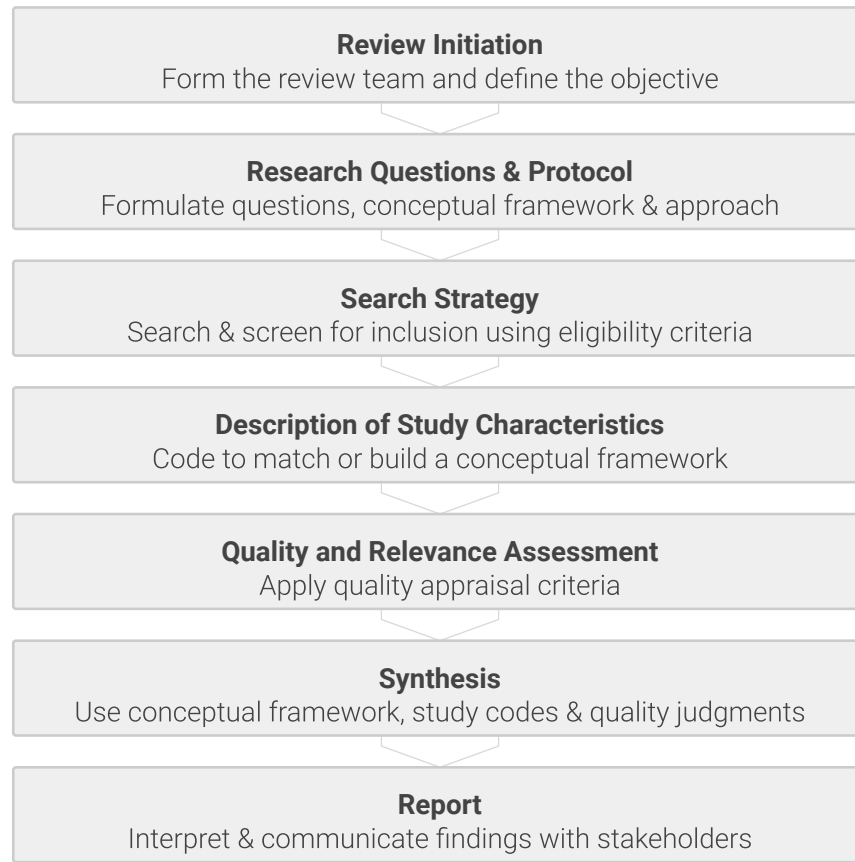


Figure 1: Systematic literature review process. Based on Gough, Oliver and Thomas [8].

public places) have explored the concepts of embodiment and coupled action and perception?

RQ2: How the concepts of embodiment and coupled action and perception have contributed to exploration and discovery in the context of interactive installations and exhibition spaces (museums and other public places)?

RQ3: Have social aspects and social interactions been considered in enactive digital systems in the context of interactive installations and exhibition spaces (museums and other public places)?

RQ4: What are the open challenges and burning issues coming from enactive digital systems in the context of interactive installations and exhibition spaces (museums and other public places)?

RQ5: What types of technologies are being used in enactive digital systems within the context of interactive installations and exhibition spaces (museums and other public places)?

It is important to emphasize that properly answering these questions is beyond the scope of this technical report, as they will only be addressed in forthcoming publications. The purpose of presenting these research questions in this technical report is to present the complete process and also because of their importance in subsequent inclusion and exclusion criteria applied to the set of retrieved documents. Starting with the exclusion criteria we defined the following ones:

EC1: The document does not have an author identified in the text

- EC2: The document does not have an abstract identified in the text
- EC3: The document is composed of less than four pages
- EC4: The document was published before the year of 2010
- EC5: The document is not in English, Portuguese or Spanish
- EC6: The document is not an indexed scientific journal article, or a book chapter, or a paper published in the proceedings of a scientific conference
- EC7: The document does not contribute to the research questions by not containing at least one of the following subjects: interactive installations, exhibition spaces, embodied cognition and related concepts, or social aspects and/or interactions in the presented system

Exclusion criteria EC1 and EC2 are necessary because we are not able to properly assess documents that do not contain an identified author or abstract. Exclusion criterion EC3 considers that documents with less than four pages are unlikely to contain sufficient material to contribute towards our research questions. Exclusion criterion EC4 is based on the assumption that, from a technological perspective, documents published before the year 2010 (roughly the last 10 years) are less likely to contribute towards the state-of-the-art in technological terms. Exclusion criterion EC5 takes into account that English is the predominant scientific publication language within Computer Science and Human-Computer Interaction (HCI), but we also included Portuguese and Spanish as these are the author's native languages. Exclusion criterion EC6 states our interest in only considering documents that, in principle, went through some kind of peer review process before being published, as is expected in journals, conference proceedings, and book chapters. Lastly, Exclusion criterion EC7 is tied directly with our research questions, stating that any document that does not have the potential towards contributing to any of our research questions should be excluded. If a document satisfies any exclusion criterion, no matter which one, it will be instantly excluded. Otherwise, the document now goes through the following inclusion criteria before being selected:

- IC1: The document has an author identified in the text
- IC2: The document has an abstract identified in the text
- IC3: The document is composed of four or more pages
- IC4: The document was published in 2010 or a more recent year
- IC5: The document is in English, Portuguese or Spanish
- IC6: The document is an indexed scientific journal article, or a book chapter, or a paper published in the proceedings of a scientific conference
- IC7: The document features interactive installations or exhibition spaces as a central aspect
- IC8: The document features embodied cognition and/or related concepts (*e.g.*, enaction, embodiment, coupled action and perception *etc.*)
- IC9: The document features social aspects and/or interactions in the presented system

Inclusion criteria IC1, IC2, IC3, IC4, IC5, and IC6 are direct opposites of their counterpart exclusion criteria, and therefore follow the same logic. Inclusion criteria IC7, IC8, and IC9, in turn, are more specific opposites of the exclusion criterion EC7, each addressing directly one topic of interest in our systematic literature review: interactive installations and exhibition spaces (IC7), embodied cognition and related concepts (IC8), and social aspects and interactions (IC9). Because inclusion criteria IC1 through IC6 are direct opposites of their counterpart exclusion criteria, they should all be satisfied for a document to be selected. Furthermore, for a document to be selected, it should also satisfy IC8 and at least another criterion between IC7 and IC9. This combination is justified by the importance of the concept of embodied cognition and related concepts within our systematic literature review, but only when combined with interactive installations and/or social aspects and interactions. Either of these topics, on their own, are not sufficient, and we considered that only selecting all of them together was too restrictive. In essence, exclusions and inclusions are handled by the following logical expressions:

$$Excluded = EC1 \text{ OR } EC2 \text{ OR } EC3 \text{ OR } EC4 \text{ OR } EC5 \text{ OR } EC6 \text{ OR } EC7$$

$$Included = IC1 \text{ AND } IC2 \text{ AND } IC3 \text{ AND } IC4 \text{ AND } IC5 \text{ AND } IC6 \text{ AND } IC8 \text{ AND } (IC7 \text{ OR } IC9)$$

## 2.2 Search Strategy

Following our research questions, we devised a search string composed of four main parts. First, the search string should screen for at least one term from a list of terms related to the concepts of embodiment and enaction, we chose: “ubiquitous”, “pervasive”, “enactive”, “sentient”, “embodied”, and “embedded”. Secondly, to investigate how these concepts have been applied in the literature, the string should screen for documents that present some kind of “system” or “environment” with some kind of “technology”, likely “digital” technology. Thirdly, the string narrows the search to our desired specific context of interactive installations and exhibition spaces with the terms: “interactive installation”, “art installation”, “installation art”, “multimodal installation”, and “museum exhibition”. Lastly, the string should screen for documents with the terms “enact”, “action”, and “perception” with the objective of further reinforcing our focus on embodied cognition. The complete string with the appropriate logical operators was written in the following format:

```
(ubiquitous OR pervasive OR enactive OR sentient OR embodied OR embedded)

AND (environment OR system) AND (technology OR digital)

AND ("interactive installation" OR "art installation" OR "installation art"
OR "multimodal installation" OR "museum exhibition")

AND (enact OR action OR perception)
```

We proceeded to submit our search string to relevant digital libraries, adjusting the string syntax according to the parameters of each digital library when needed while still preserving its logic. We chose the following digital libraries due to their relevance in the field of HCI: ACM Digital Library<sup>1</sup> with the search expanded to also include the larger database known as “ACM Guide to Computing

---

<sup>1</sup><https://dl.acm.org/>

Literature<sup>2</sup>; IEEE Xplore<sup>2</sup>; SpringerLink<sup>3</sup>; and Scopus<sup>4</sup>. This combination of digital libraries was considered both necessary and sufficient as it encompassed all of the top 20 journals and conference proceedings in the field of HCI according to Google Scholar<sup>5</sup> (measured by h5-index with data from June 2020). Furthermore, we also considered using the Scielo<sup>6</sup> digital library because of its overall relevance in Latin America, but our search string returned no results in this database. Some technical details about the actual search, conducted on July 25, 2020, and the number of results obtained from each digital library are presented as follows:

- **ACM Digital Library:** 1002 results were returned. The results were exported in the BibTeX format, but a limitation of only exporting at most 100 entries at a time required 11 individual exports that had to be manually merged. Another limitation of this digital library is that the generated BibTeX does not contain a field for the abstract of the document, which we later had to obtain through a custom-made web scraping script.
- **IEEE Xplore:** 1 result was returned. The result was exported in the BibTeX format already containing the field for the document’s abstract.
- **SpringerLink:** 1676 results were returned. SpringerLink only allows the results to be exported in the Comma-separated Values (CSV) format and with a limitation of only exporting 1000 entries at a time, requiring 2 individual exports that had to be manually merged. To obtain the entries in the BibTeX format, we used the Crossref REST API<sup>7</sup> to lookup the documents in the exported CSV through their Digital Object Identifier (DOI) and obtain them again, but this time in the BibTeX format. The abstract of the documents was also not present and was later obtained through a custom-made web scraping script.
- **Scopus:** 566 results were returned. The results were exported in the BibTeX format already containing the field for the documents’ abstracts.

To consolidate our data we used the JabRef<sup>8</sup> reference management software to normalize all the BibTeX entries and generate a single file. This first step, labeled as identification in the flow diagram in Figure 2, provided us with 3245 document entries to be screened according to our inclusion and exclusion criteria. In the screening phase, the JabRef software was used to find and exclude, as illustrated in Figure 2, 300 duplicate entries, 97 entries for entire books or proceedings (exclusion criterion EC6), 7 entries with unidentified authors (EC1), 139 entries with unidentified abstract (EC2), 70 entries with less than four pages (EC3), and 484 entries published before the year of 2010 (EC4). From this point, we exported the results to a shared spreadsheet for the authors to work collaboratively. Still in the screening phase, through the manual screening of titles and abstracts of the remaining data, further 1665 entries were deemed not on topic, *i.e.*, showed no clues towards contributing to our research questions (EC7) and therefore were also excluded. A total of 483 entries remained to be assessed in the next phase: eligibility.

To assess the eligibility of the remaining 483 entries, we obtained their full-texts. With the exception of 8 entries to which we were not able to obtain the full-text, we skimmed through all the entries’ full-texts paying attention to inclusion criteria IC7, IC8, and IC9. Considering the protocol

---

<sup>2</sup><https://ieeexplore.ieee.org/>

<sup>3</sup><https://link.springer.com/>

<sup>4</sup><https://www.scopus.com/>

<sup>5</sup>[https://scholar.google.es/citations?view\\_op=top\\_venues&vq=eng\\_humancomputerinteraction](https://scholar.google.es/citations?view_op=top_venues&vq=eng_humancomputerinteraction)

<sup>6</sup><https://scielo.org/>

<sup>7</sup><https://www.crossref.org/education/retrieve-metadata/rest-api/>

<sup>8</sup><https://www.jabref.org/>

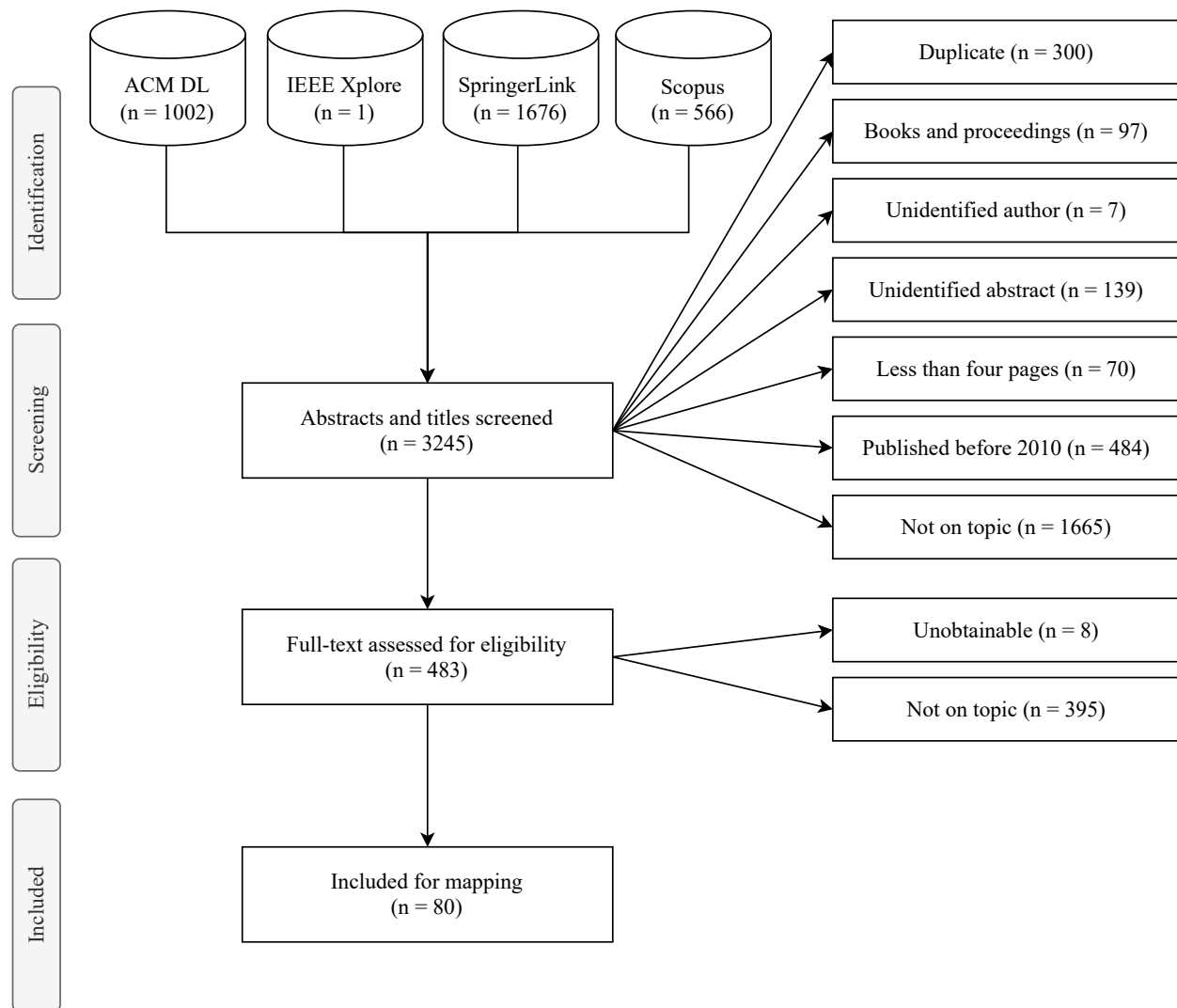


Figure 2: Search and selection flow diagram. Based on the PRISMA Flow Diagram [14].

previously described in Section 2.1, 395 entries were deemed not on topic, 169 of which because they satisfied exclusion criterion EC7 (through the full-text assessment it becomes possible to reveal that some possible clues found in titles and abstracts during the screening phase are not always present in the document in the way they were expected to be, leading to new exclusions). The other 226 entries were deemed not on the topic because they did not meet our rule of inclusion by satisfying both inclusion criteria IC8 and at least one among IC7 and IC9. Of the remaining 80 entries now considered included to be mapped and analyzed, 13 entries satisfied inclusion criteria IC8, IC7, and IC9, 59 entries satisfied only inclusion criteria IC8 and IC7 (interactive installations or exhibition spaces as central aspect, and embodied cognition and/or related concepts), and 8 entries satisfied only inclusion criteria IC8 and IC9 (embodied cognition and/or related concepts, and social aspects and/or interactions in the presented system).



### 2.3 Description of Study Characteristics

In this phase, we thoroughly read each of the selected full-texts and proceeded to fill in a form with two main sets of questions regarding the document (the form is presented in its entirety in Appendix A). These questions are aimed at mapping and describing the characteristics of the selected entries. The first main set of questions regarded more general aspects of the document as it asked:

- What are the authors' affiliation countries?
- What kind of institutions are the authors affiliated to?
- Is there a practical application in the study? If so, what is the context?
- Is there a target audience in the study? If so, who is the target audience?
- In general research terms, what is the methodological approach of the study?
- Does the study cover the design of an artifact or system? If so, what is the design methodology?
- Does the study have some kind of evaluation? If so, what is evaluated and how?

The second main set of questions covers concepts directly related to our research questions in this systematic literature review. We created six categories of central importance to us, each represented in its own question. For each question and category, in turn, there is a set of descriptors to be selected as check-boxes when appropriate (there is also an open field for additional comments and suggestions of new descriptors). The filling of this section of the form went as follows: while filling in the form for a specific document among the selected collection, for each category we selected the descriptors we considered to be somehow present in the document, not only literally, but also conceptually or in equivalence. The six categories and their descriptors are:

- **Technology:** what are the used computational technologies besides computers?
  - Actuator: output devices (*e.g.*, LEDs, speakers, motors *etc.*)
  - Microcontroller: embedded computers (*e.g.*, Arduino, Raspberry Pi *etc.*)
  - Display: image output devices (*e.g.*, TV, projector *etc.*)
  - Embedded: computational technology embedded into something
  - NUI: natural user interface technologies (*e.g.*, Microsoft Kinect)
  - Robotics: use of robots or robotic components (*e.g.*, mBot)
  - Sensor: input devices (*e.g.*, proximity, touch, microphone, camera *etc.*)
  - Tabletop: interactive tabletop with an embedded display and tangible devices
  - Tangible: digital information made concrete by the handling of physical objects
  - Wearable: clothing and wearable accessories with computational capabilities
  - Wireless: wireless communication technologies (*e.g.*, Wi-Fi, Bluetooth *etc.*)
- **Interaction:** how does the interaction with computational technology take place?
  - Embodied Interaction: body use in a natural and significant way (*e.g.*, Dourish [4])
  - Full-body Interaction: interaction through the use of the whole body

- Gaze: interaction through gaze detection and eye-tracking
- Gesture: interaction through intentional gestures
- Motion: interaction through movement (not necessarily intentional)
- Physiological Information: interaction through physiological data (*e.g.* heart rate)
- Tangible Interaction: interaction through the handling of physical objects
- Voice: interaction through the use of voice
- **Embodiment:** how is the human body considered and involved in the interaction?
  - Bodily Actions: corporal actions (*e.g.*, heartbeat, head and eyes position *etc.*)
  - Body Movements: any kind of body movement (*e.g.*, arms, legs *etc.*)
  - Embodied Action: perceptually guided action (*e.g.*, Varela *et al.* [15])
  - Embodied Cognition (EC): cognition not only in the brain, also involves the body
  - Embodied Interaction: body use in a natural and significant way (*e.g.*, Dourish [4])
  - Full-body Interaction: interaction through the use of the whole body
- **Enactive:** how is embodied cognition considered and involved in the interaction?
  - Action: to act on the world, fundamentally inseparable from perception
  - Autopoiesis: capability of reproduce and maintain itself (*e.g.*, Maturana and Varela [12])
  - Embodied Cognition (EC): cognition not only in the brain, also involves the body
  - Embodied Mind: cognition as interdependent body and mind (*e.g.*, Varela *et al.* [15])
  - Sense-Making: creation of meaning through interactions
  - Ontogenetic Drift: learning as constant change, a history of the self (*e.g.*, Maturana [11])
  - Perception: to perceive the world, fundamentally inseparable from action
- **Social:** how are social aspects and interactions present in the study?
  - Social Awareness: awareness of the influence of others and on others
  - Collaboration: collaboration/participation/cooperation to solve a problem
  - Competition: competition between two or more people (*e.g.*, competitive game)
  - Conversation: use of language for communication (*e.g.*, voice, gesture, expressions *etc.*)
  - Coordination: coordinated actions among different people, possibly with leadership
  - Group Behavioral Changing: behavior change through social interaction
  - Group Interaction: dynamic in which members of a group interact with each other
  - Social Fiction: socially imagine alternative realities or possible futures
  - Social Interaction: process of mutual influence among people
- **Interactive Installation:** what kind of installation is portrayed in the study?
  - Art Installation: artistic emphasis on aesthetics and experience
  - Cinema Installation: explores the concept and the physical space of a movie theater
  - Educational Installation: has an educational focus, possibly in an educational context

- Emotional Installation: focus on detecting or allowing the expression of emotions
- Enactive Installation: has a degree of autonomy (*e.g.*, Varela *et al.* [15])
- Multimodal Installation: different modalities of interaction and data input and output
- Music/sound Installation: focus on music and/or sonority in general
- Playful Installation: focus on playfulness, fun, games (*e.g.*, Costello and Edmonds [3])
- Public Space/Installation: located in public and free circulation spaces
- Tangible Installation: focus on interaction through the handling of physical objects
- Wearable Installation: artifacts that can be worn as part of the installation

At the end of the form, there were also open questions about other possible categories and descriptors, as well as general considerations. After thoroughly reading each of the selected full-texts and filling in the form once for each document, we now have the necessary information to proceed towards assessing their quality and relevance in relation to our systematic literature review.

## 2.4 Quality and Relevance Assessment

To calculate the quality of the selected documents and their relevance towards our research questions, we conducted a quality and relevance assessment based on two sets of parameters. The first set is composed by quality parameters that can be considered as overall evidence of the quality of the documents. The quality parameters are presented as follows:

QP1: Is the **design process** of the proposal described in detail? (Yes = 1; No = 0)

QP2: Is the **methodology** of the study described in detail? (Yes = 1; No = 0)

QP3: Is there a **practical application** in the study? (Yes = 1; No = 0)

QP4: Is there any **evaluation** of the proposed system? (Yes = 1; No = 0)

QP5: Is there any **user participation** during the evaluation? (Yes = 1; No = 0)

QP6: What is the **citations per year** percentile of the document? (Max = 1; Min = 0)

QP7: What is the **h5-index** percentile of the journal or conference? (Max = 1; Min = 0)

Quality parameters QP1 through QP5 have a binary response: if the answer is “yes”, the numerical value of the parameter will be 1, otherwise, it will be 0. Their response is determined by our thorough reading of the full-texts. Quality parameters QP6 and QP7, in turn, are derived from citation and h5-index values respectively, obtained from Google Scholar<sup>9</sup> on December 7, 2020. For quality parameter QP6, we obtained the number of citations of each document, then we normalized the value by calculating the number of citations per year since the document was published, and finally calculated the percentile of each value of citations per year within our set of selected entries. For quality parameter QP7 we first attributed the value of 0 for entries with no h5-index value available, and then also calculated the h5-index percentile of the documents within our set of selected entries. After dividing each percentile by 100, both quality parameters QP6 and QP7 are left with responses that range from 0 to 1 with two decimal places. Finally, the overall quality is calculated as a simple average of the values of quality parameters QP1 through QP7.

---

<sup>9</sup><https://scholar.google.com/>

The second set, equally important, is composed by relevance parameters that can be considered as overall evidence of the relevance of the documents towards the objectives of this systematic literature review. The relevance parameters are presented as follows:

- RP1: How much is the “**technology**” category covered?  
(Equal or above median = 1; Below median = 0.5; Not covered = 0)
- RP2: How much is the “**interaction**” category covered?  
(Equal or above median = 1; Below median = 0.5; Not covered = 0)
- RP3: How much is the “**embodiment**” category covered?  
(Equal or above median = 1; Below median = 0.5; Not covered = 0)
- RP4: How much is the “**enactive**” category covered?  
(Equal or above median = 1; Below median = 0.5; Not covered = 0)
- RP5: How much is the “**social**” category covered?  
(Equal or above median = 1; Below median = 0.5; Not covered = 0)
- RP6: How much is the “**Interactive Installation**” category covered?  
(Equal or above median = 1; Below median = 0.5; Not covered = 0)

There is one relevance parameter for each category presented in Section 2.3. For each relevance parameter from RP1 through RP6, the numerical value is calculated according to how many descriptors were selected for that category. More specifically, if no descriptor was selected the value is going to be 0, if the number of selected descriptors is more than 0 but less than the median of selected descriptors for the entire set the value is going to be 0.5, and if the value is equal or greater than the median it is going to be 1. To calculate an overall relevance value we first add a weight of 3 to RP1 and RP2, and a weight of 5 for RP3 through RP6 because we consider these last four parameters to be significantly more important to our research questions, then we calculate a simple weighted average of the values. Finally, for the sake of simplicity, we calculate a single value for quality and relevance by means of a simple average between the two. The equations used to calculate the quality, relevance, and the combined value for quality and relevance are the following:

$$Quality = \frac{QP1 + QP2 + QP3 + QP4 + QP5 + QP6 + QP7}{7}$$

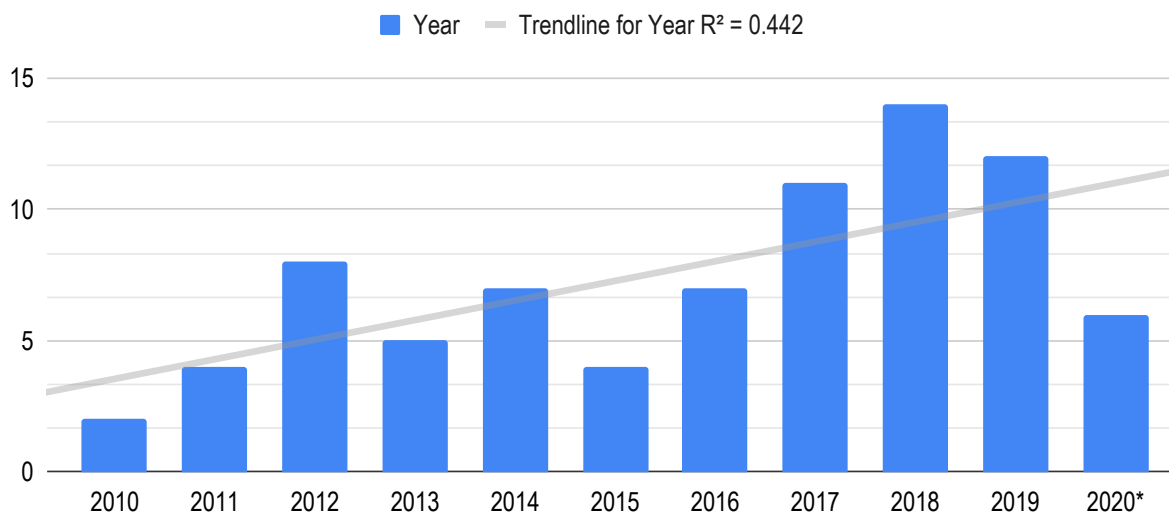
$$Relevance = \frac{(RP1 \times 3) + (RP2 \times 3) + (RP3 \times 5) + (RP4 \times 5) + (RP5 \times 5) + (RP6 \times 5)}{26}$$

$$Quality \ \& \ Relevance = \frac{Quality + Relevance}{2}$$

### 3 Preliminary Results

In this section we will discuss some characteristics of the 80 selected documents, starting with their distribution throughout the time interval between 2010 and 2020 (it is important to keep in mind that the year of 2020 is limited up to July 25, the date at which the search was conducted). This distribution, along with a trendline, is illustrated in Figure 3. In the following sections we will

cover the data collected in the form such as who are the authors, where are they located, and of what kind is their institutional affiliation; where were these documents published between journals, conference proceedings and books. Furthermore, we will also summarize information regarding the application context reported in the document, if applicable, as well as data regarding evaluation and results from the quality and relevance analysis. For reference, these are the 80 selected entries: [S51, S71, S43, S62, S76, S39, S48, S50, S79, S73, S3, S66, S21, S69, S47, S74, S1, S28, S17, S30, S67, S16, S29, S12, S8, S2, S4, S5, S6, S7, S9, S10, S11, S13, S14, S15, S18, S19, S20, S22, S23, S24, S25, S26, S27, S35, S31, S32, S33, S34, S36, S37, S38, S40, S41, S42, S44, S45, S46, S49, S52, S53, S54, S55, S56, S57, S58, S59, S60, S61, S63, S64, S65, S68, S70, S72, S75, S77, S78, S80].



\* 2020 is limited up to July 25, the date at which the search was conducted.

Figure 3: Chart of selected documents per year.

### 3.1 Authors

We identified 206 unique authors among the 80 entries of our systematic literature review. Within this set, 20 people authored more than one document. There are 14 authors who authored two documents: A. Fatah Gen. Schieck [S2, S19], A. Moroni [S26, S44], G. Paine [S5, S59], J. Mora-Guiard [S50, S49], J. Y. Ma [S32, S33], L. Loke [S39, S53], L. Tan [S69, S68], M. L. Kelton [S32, S33], N. Pares [S50, S49], P. Dalsgaard [S13, S22], P. Pasquier [S67, S56], S. F. Alaoui [S21, S28], Y. Candau [S21, S6], and Y. L. M. Mendoza [S16, S46]. There are 5 authors who authored three documents: B. E. Riecke [S76, S67, S56], E. F. Duarte [S16, S14, S15], J. Françoise [S21, S6, S7], J. Manzolli [S26, S44, S65], and T. Schiphorst [S62, S21, S6]. And there is one author who authored four documents: M. C. C. Baranauskas [S16, S14, S15, S46]. The remaining 186 authors have all authored a single document. An overview of all the 206 authors and their number of authorships within our set of 80 entries is illustrated in the author cloud depicted in Figure 4. Summing the number of authors for each of the 80 entries, we have a total of 233 authorships.

These 233 authorships are distributed between 22 countries (it is important to emphasize that this data does not necessarily reflect nationality, but instead it considers the country of institutional



Figure 4: Author cloud with the 206 authors, size varying between 4 and 1 authorships.

affiliation exactly as provided by the authors on the first page of their full-texts). In the chart illustrated in Figure 5 we quantify how many authorships and publications each country has. For instance, if one document has three authors from the same country, that counts as three authorships and one publication for that country. Likewise, if a document has two authors from different countries, that counts as one authorship and one publication for each country. It can be noticed that the sum of authorships in Figure 5 is 234 instead of 233, this is the case because one author was affiliated with two institutions in different countries [S24]. Furthermore, eight entries with authors from two different countries [S21, S6, S7, S23, S24, S27, S59, S75] and one entry with authors from four different countries [S80] justifies the sum of publications in Figure 5 being 91. Similarly, Figure 6a illustrates how these authorships and publications are distributed between continents.

From what is provided by the authors on the first page of their full-texts we can also identify what kind of institutions the authors were affiliated with at the time. We were able to identify authors from academia, research centers or institutes, private initiative, independent, a public library, and a museum. Analogous to how we quantified the authorships and publications per country and per continent as illustrated in Figures 5 and 6a, we also quantified how many authorships and publications each institution type has. This quantification is illustrated in Figure 6b.

### 3.2 Journals, Conferences, and Books

Of the 80 entries, 17 are articles published in scientific journals. Among the remaining 63 entries, 43 are papers published in scientific conference proceedings, and 20 are book chapters. Furthermore, 9 out of the 20 book chapters are in fact papers from conferences that choose to publish their pro-

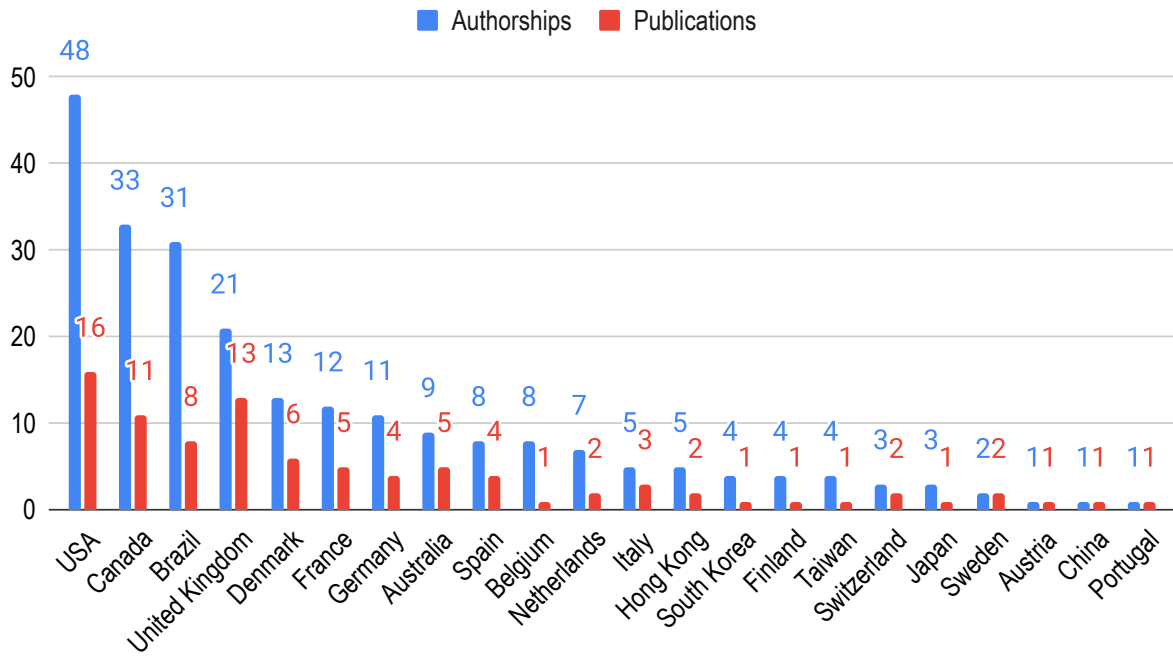
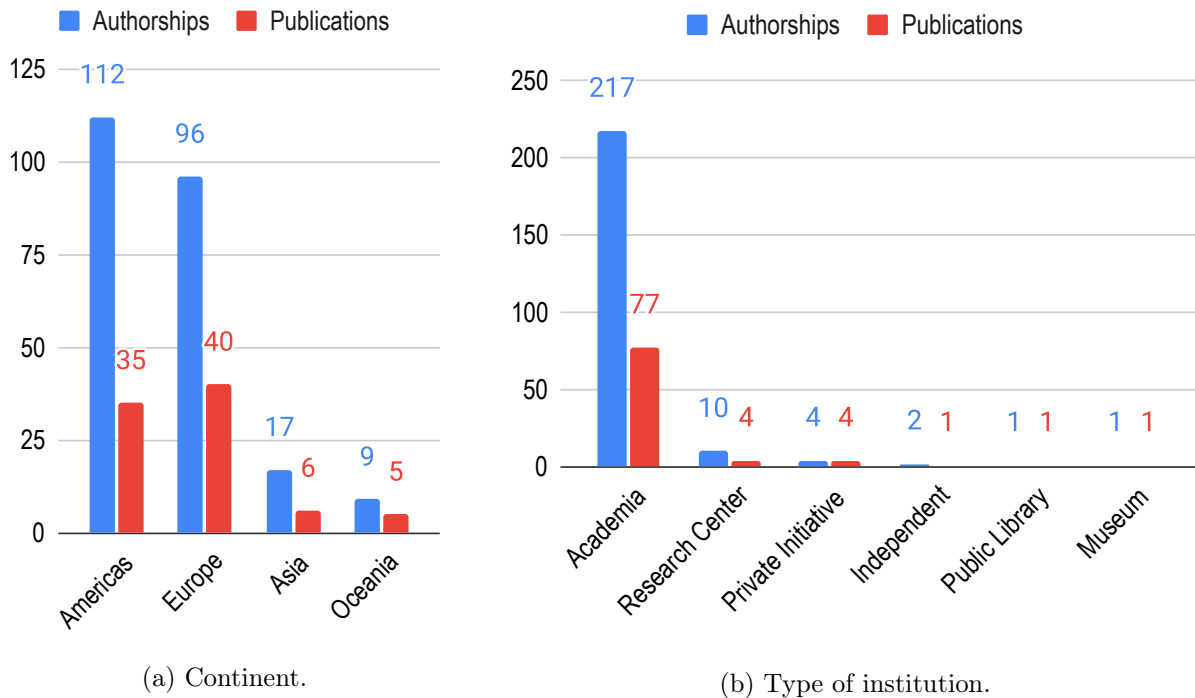


Figure 5: Chart of authorships and publications by country.



(a) Continent.

(b) Type of institution.

Figure 6: Charts of authorships and publications by continents and type of institution.

ceedings as books. Therefore, in this section, we will treat them as conference papers to accurately reflect their origin. With this consideration in mind, the 17 journal articles are distributed between different 17 journals, the 52 conference papers are distributed between 29 different conferences, and the 11 book chapters are distributed between 11 different books. All of the journals, conferences, and books featured in the 80 selected entries, as well as their respective articles, papers, and chapters, are summarized in Table 1.

### 3.3 Application Context

Out of the 80 selected entries, we considered that 6 of them had no practical application context because they were presented as literature reviews. Out of the remaining 74 entries, 42 of them were applied in exhibition contexts and 32 in laboratory contexts. For the 42 entries with exhibition application contexts, we further categorized them with 26 being exhibited in public spaces (*e.g.*, museums, urban areas *etc.*), and 16 being exhibited in closed spaces (*e.g.*, academic conferences, closed exhibits *etc.*). To better clarify our terminology, by laboratory we do not mean the literal word, but instead, a controlled environment in which the researchers can control major aspects of the context, mainly who is participating and how, which is usually a select group at a specific time in a specific space within a university or research center. By exhibit, in turn, we mean the opposite of laboratory, *i.e.*, an environment in which the researchers do not have control of some major aspects of the context, mainly who is participating and how, usually random visitors in an art or science institution, or even passersby in a public space at any given time, interacting at will.

Regarding more specific aspects of the physical context, we identified the following categories (with the number of instances in parenthesis): Room (17), Art & Technology Exhibition (13), Ambient Projection (10), University (10), Academic Conference (6), Science Museum (6), Table (5), Urban Area (5), Virtual Reality (5), Classroom (4), School (4), Art Museum (3), Dance Studio (3), Dark Room (3), Workshop (3), Music Festival (2), Stairway (2), Aquarium (1), Archaeology Museum (1), Cinema (1), Clinic (1), Cloister (1), Film Museum (1), History Museum (1), Hotel (1), Installation (1), Special Education (1), Stations (1), Street Fair (1), Textile Museum (1), Trade Fair (1), and Wall-mounted Device (1). Furthermore, regarding specific aspects of the contextual theme, we identified the following categories (also with the number of instances in parenthesis): Self-expression (25), Musical Instrument (13), Dance Performance (8), Social Interaction (7), Human-Robot Interaction (4), Affect (3), Digital Agent (3), Storytelling (3), Co-design (2), Deep Time (2), Engagement (2), Entertainment (2), Mathematics (2), Mindfulness Meditation (2), Aesthetic Experience (1), Anatomy (1), Artificial Life (1), Astronomy (1), Biofeedback (1), Consciousness (1), Enactive Experience (1), Immune System (1), Interaction Medium (1), Mixed Reality (1), Musical Performance (1), Nanoscale (1), Play Therapy (1), Public Space (1), Sense of Smell (1), Sensory Anthropology (1), Sensory Outputs (1), Somatic Connoisseurship (1), Sound Creation (1), Synthetic Biology (1), Topography (1), Visualization (1), Wellbeing (1), and Wiki (1).

From the 80 selected entries, we identified that 33 entries did not report information about the audience and people's involvement in their studies. Those works included studies that only presented and described interactive installations or exhibitions, systematic reviews, research agenda suggestions, and research proposals. Among the documents that reported information about their participants, we identified that only 5 entries (6.25%) involved children and/or teenagers, 21 entries (26.25%) involved adults, 19 entries (23.75%) involved a general audience including children, teenagers, and adults of different ages; and 36 entries (45%) omitted this information. Regarding the number of participants, 14 entries (17.5%) included less than 20 participants, 11 entries (13.75%) included between 20 and 50 participants, 10 entries (12.5%) included more than 50 participants, and 45 entries (56.25%) omitted this information. Furthermore, we found that 13 out of the 80 doc-



Table 1: List of journals, conferences, and books and their respective articles, papers and chapters.

Journal	Article
AI & SOCIETY	[S20]
Artificial Life	[S54]
Cognition and Instruction	[S33]
Cognitive Computation	[S23]
Computer Music Journal	[S7]
Digital Creativity	[S72]
Educational Studies in Mathematics	[S32]
Interacting with Computers	[S80]
International Journal of Arts and Technology	[S41]
International Journal of Computer-Supported Collaborative Learning	[S58]
Journal on Computing and Cultural Heritage	[S77]
Journal on Multimodal User Interfaces	[S75]
Paladyn, Journal of Behavioral Robotics	[S11]
Personal and Ubiquitous Computing	[S64]
Universal Access in the Information Society	[S45]
User Modeling and User-Adapted Interaction	[S71]
Visual Anthropology Review	[S60]
Conference Name	Paper(s)
Designing Interactive Systems Conference (DIS)	[S76, S39, S67, S16, S12, S2, S22]
International Conference on Human-Computer Interaction (HCI)	[S31, S38, S40, S56, S63]
ACM Conference on Human Factors in Computing Systems (CHI)	[S62, S21, S47, S28, S17]
International Conference on Tangible, Embedded, and Embodied Interaction (TEI)	[S43, S73, S29, S59]
International Academic Mindtrek Conference (AcademicMindtrek)	[S66, S19]
IFIP Conference on Human-Computer Interaction (INTERACT)	[S13, S61]
Conference on Interaction Design and Children (IDC)	[S50, S42]
Conference on Creativity and Cognition (C&C)	[S10, S24]
Brazilian Symposium on Human Factors in Computing Systems (IHC)	[S14, S46]
Australian Conference on Computer-Human Interaction (OzCHI)	[S15, S53]
Virtual Reality International Conference (VRIC)	[S3]
Society for the Study of Artificial Intelligence and the Simulation of Behaviour (AISB)	[S37]
Special Interest Group on Computer Graphics and Interactive Techniques (SIGGRAPH)	[S48]
Nordic Conference on Human-Computer Interaction (NordiCHI)	[S74]
International Workshop on Human Behavior Understanding (HBU)	[S51]
International Symposium on Pervasive Displays (PerDis)	[S79]
Int. Symposium on Pervasive Computing Paradigms for Mental Health (MindCare)	[S49]
International Symposium on Computer Music Multidisciplinary Research (CMMR)	[S44]
International Symposium of Chinese CHI (Chinese CHI)	[S69]
International Conference on the Foundations of Digital Games (FDG)	[S27]
International Conference on Movement and Computing (MOCO)	[S30]
International Conference on Entertainment Computing (ICEC)	[S35]
International Conference on Digital and Interactive Arts (ARTECH)	[S26]
International Conference on Design, Learning, and Innovation (DLI) and International Conference on ArtsIT, Interactivity and Game Creation (ArtsIT)	[S18]
International Conference on Applied Human Factors and Ergonomics (AHFE)	[S68]
International BCS Human Computer Interaction Conference (HCI)	[S57]
IEEE International Symposium on Mixed and Augmented Reality - Arts, Media and Humanities (ISMAR-AMH)	[S36]
Eurographics Workshop on Graphics and Cultural Heritage (GCH)	[S8]
Audio Mostly (AM)	[S1]
Book Title	Chapter
Aesthetics and the Embodied Mind: Beyond Art Theory and the Cartesian Mind-Body Dichotomy	[S25]
Data-driven Multivalence in the Built Environment	[S4]
Digital Bodies	[S55]
Digital Echoes	[S78]
Electronic Visualisation in Arts and Culture	[S52]
Intimacy Across Visceral and Digital Performance	[S70]
Knowledge Visualization Currents	[S34]
Model-Based Reasoning in Science and Technology	[S65]
New Directions in Music and Human-Computer Interaction	[S5]
New Directions in Third Wave Human-Computer Interaction: Volume 2 - Methodologies	[S6]
Playful Disruption of Digital Media	[S9]

uments (16.25%) explicitly mention either approval from an ethics committee or at least informed consent from the participants.

### 3.4 Evaluation

From the 80 selected entries, we found that 45 studies conducted some evaluation of the proposed ubiquitous system by using a diversity of evaluation methods. Among the 35 studies without mention of an explicit evaluation process, an evaluation was not applicable to 4 of them because 2 were literature reviews, 1 was a research agenda proposal, and 1 was a doctoral thesis research proposal. For the 45 entries with evaluation, we also looked further into what was the subject of evaluation (*i.e.*, what is being evaluated), and what were the methods applied (*i.e.*, how the evaluation was conducted by the researchers).

Regarding the subject of evaluation, we identified 14 categories: seven categories target people directly: “People’s experience”, “People’s behaviour”, “Learning”, “User engagement”, “User perception”, “Affective states”, and “Social”; another three are system related categories: “Functionality”, “Usefulness”, and “Artifacts”; and lastly there are categories that are “in between”, relating to both people and system: “Scenario”, “Interaction”, “Usability”, and “System usage”. An overview of the distribution of subjects of evaluation can be seen in Figure 7.

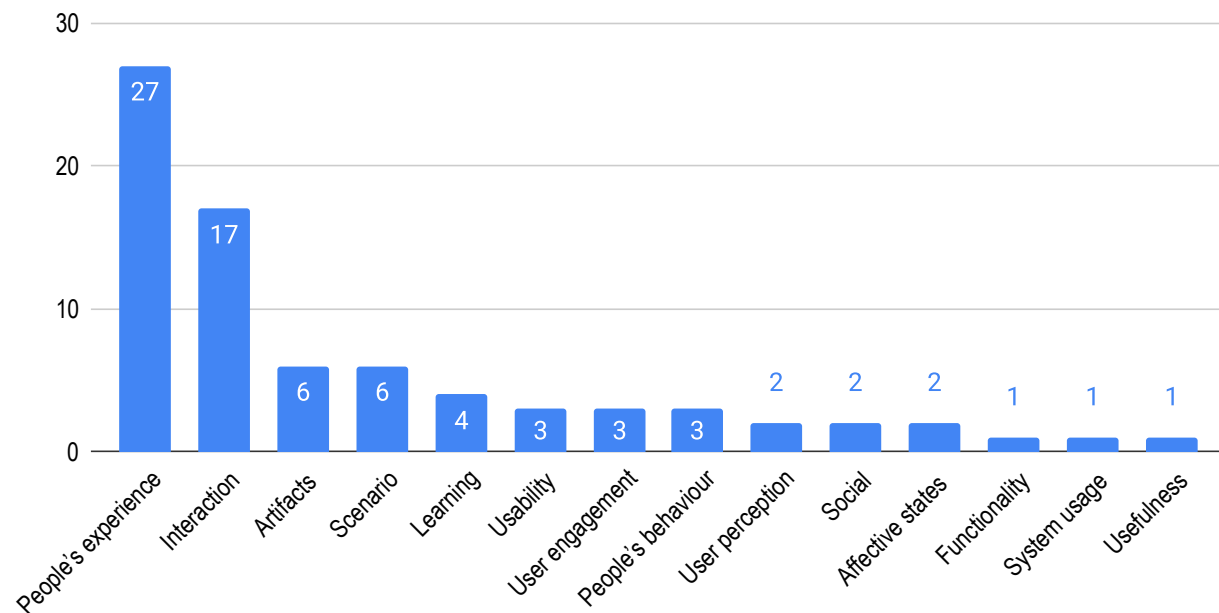


Figure 7: Chart of the distribution of categories for subjects of evaluation.

Regarding the evaluation methods applied, they are mostly related to different types of interviews, video analysis, different types of questionnaires, and observations made by researchers. From the works that address evaluation, we identified methods in 8 categories: “Interview”, “Video Analysis”, “Questionnaire”, “Observation”, “System logs”, “Automatic Analysis”, “Physiological Measurement”, and “Other methods”. An overview of the distribution of categories for methods of evaluation is illustrated in Figure 8. It is worth noting that the sum of methods is larger than the number of papers because some of those works used more than one evaluation method.

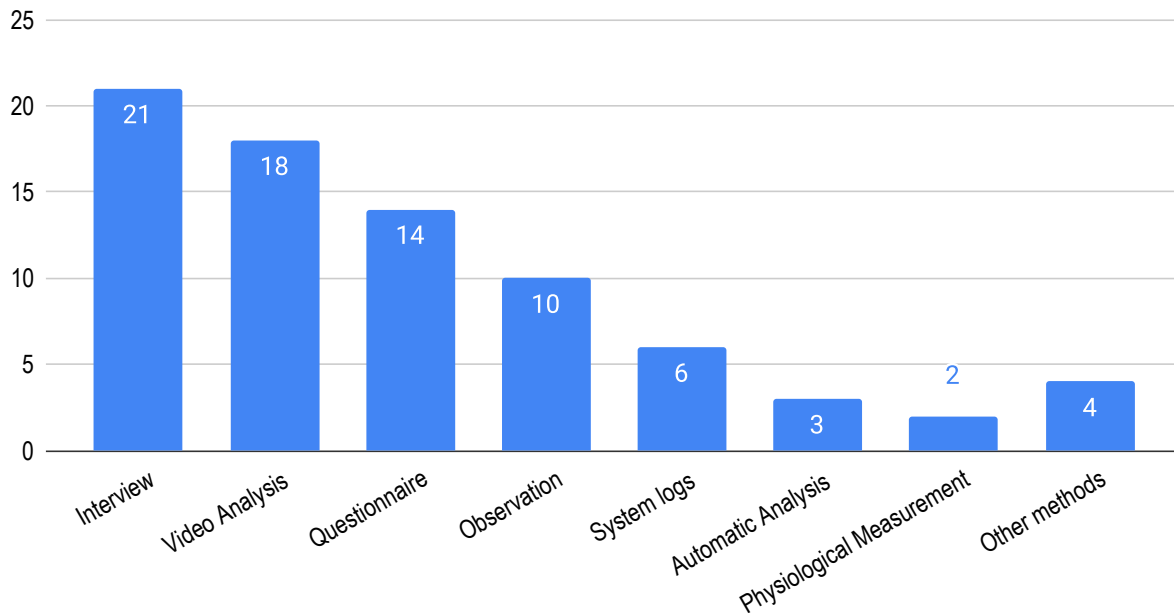


Figure 8: Chart of the distribution of categories for methods of evaluation.

Further analysis of evaluation aspects related to this systematic literature review is thoroughly discussed in [13].

### 3.5 Quality and Relevance

The calculated score for the quality of the entries had an average value of 0.60 with a standard deviation of 0.24. The calculated score for the relevance of the entries, in turn, had an average value of 0.80 with a standard deviation of 0.24. Using these two values to calculate a combined quality and relevance score, from a value that ranged from 0 to 1, the 80 selected entries achieved a combined quality and relevance average score of 0.7 with a standard deviation of 0.19. A total of 29 entries achieved a score between 1 and 0.8, 30 entries achieved a score between 0.8 and 0.6, 13 entries had a score between 0.6 and 0.4, and 8 entries scored below 0.4, with the minimum score being 0.20. All the quality and relevance assessment scores can be visualized in the chart presented in Figure 9, which contains both the individual values for quality and relevance scores, as well as the combined quality and relevance metric which is used to rank the entries in the chart.

## 4 Discussion

A preliminary analysis of the selected 80 entries reveals important aspects of these documents. First, we identified that the number of publications on the subject of enactment and embodiment in the context of interactive installations has been growing between the years of 2010 and 2020 (our analyzed interval). Even taking into account that the year 2020 is not complete due to the search being conducted on July 25, 2020, the trendline illustrated in Figure 3 shows a tendency of growth in the number of publications per year. This growth, in turn, may signify that the subject of our systematic literature review has been gaining importance among researchers and publication

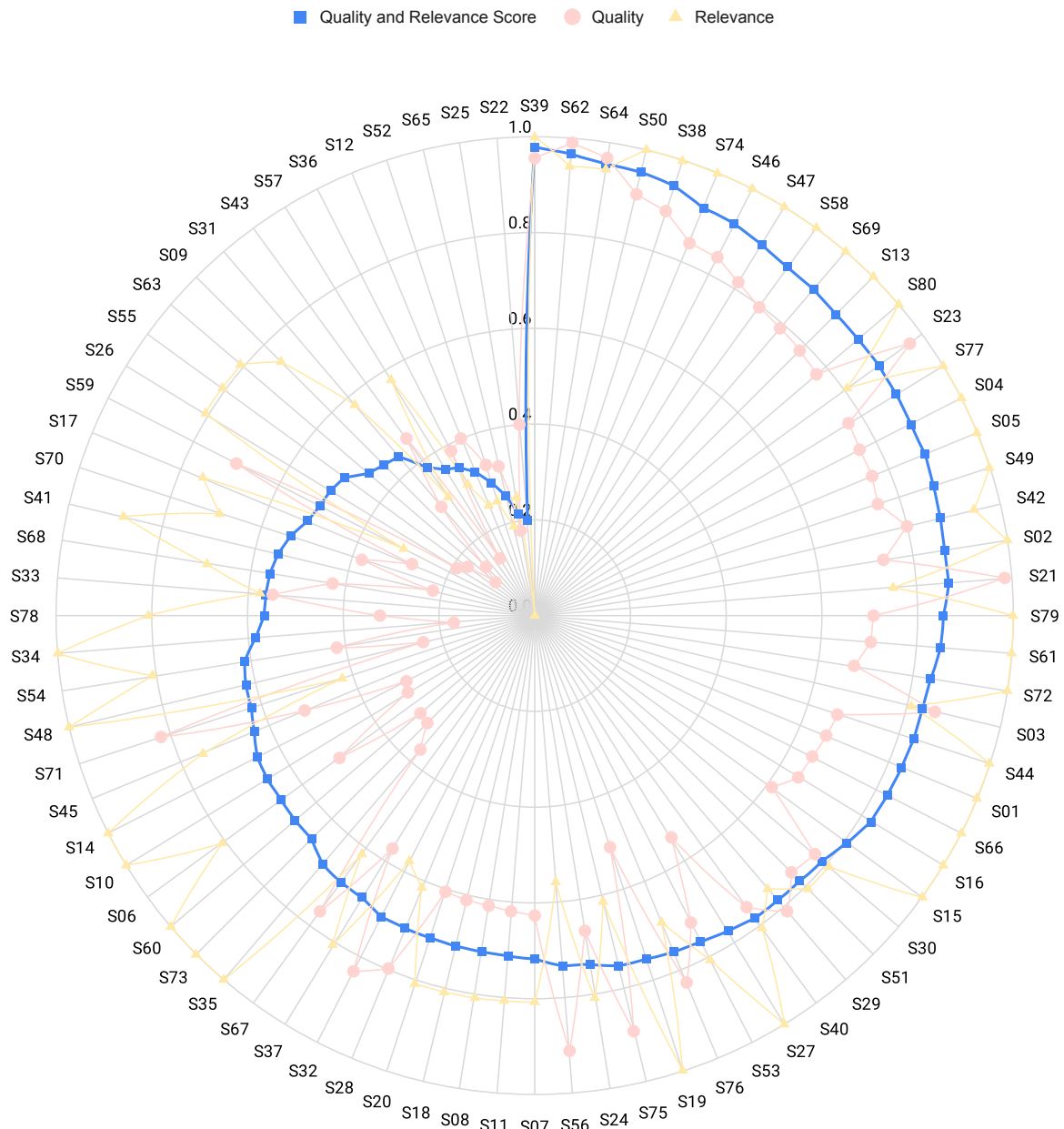


Figure 9: Chart of the calculated score of the quality and relevance assessment.

vehicles in HCI and related fields.

Speaking about researchers, a relatively significant number of authors (206 in our review) are in some manner involved with enaction, embodiment, and interactive installations, some of them with up to four recurring authorships. These authors are affiliated with institutions mainly in the Americas and Europe. Asia and Oceania are also represented to a lesser extent, and we found no documents from institutions located in Africa. Furthermore, our quantification of authorships and publications per country and per continent reveals what may be a noteworthy cultural difference. In the Americas, we identified an average of 3.2 authors per publication, while in Europe this number is 2.4. This difference is even more evident looking at specific countries: Brazil has an average of roughly 3.87 authors per publication, while the UK has an average of roughly 1.61. We cannot properly assess why this discrepancy takes place, but we can conjecture that researchers from these countries and continents have different perspectives on what qualifies a person as an author. These different perspectives, in turn, may be motivated by controversial metrics applied to research funding and career progression, among other factors.

On the subject of publication venues, the distribution between 17 journals, 29 conferences, and 11 books reveals that the topic of enaction and embodiment in interactive installations is relatively widely distributed in the literature. On the one hand, there is a concentration of documents in a few conferences, such as the Designing Interactive Systems Conference (DIS) with 7 documents, the International Conference on Human-Computer Interaction (HCII), and the ACM Conference on Human Factors in Computing Systems (CHI) with 5 documents each, and International Conference on Tangible, Embedded, and Embodied Interaction (TEI) with 4 documents (other 6 conferences had two documents each). This concentration suggests that the topic of our review is to some degree established in these venues. On the other hand, all the 17 journals, 11 books, and the remaining 19 conferences had a single document among the 80 selected documents, suggesting that besides being somewhat established in the aforementioned conferences, the topic of our review also has a foothold in a wide range publication venues across multiple different communities of research.

Moving on to some aspects of the content of the selected documents, an analysis of the application contexts gives us an overview of where and how are these studies being applied. With the exception of 6 studies with no practical application context, the other 74 studies were divided into contexts of exhibition (42) and laboratory (32), showing a slight preference for *in the wild* studies against controlled environments. Taking into account both exhibition and laboratory studies, there was a wide variety of kinds of physical spaces (urban areas, academic institutions, varied exhibitions *etc.*) and interaction themes (self-expression, music instruments, dance performances *etc.*). Another relevant aspect of the application context is that only 13 out of the 80 works explicitly mention either a research ethics committee approval or at least informed consent from the participants. Regardless of whether this information is just not made explicit in the full-texts, or there was no research ethics committee and consent forms involved at all, this low number suggests that this ethical aspect has been overlooked by researchers, peer-reviewers, and publication vehicles.

On the subject of evaluation, only 45 out of 80 works (56.25%) had some form of evaluation, a relatively low number considering how the evaluation of interactive systems is a core activity within the field of HCI. Although we cannot explain why the remaining 31 works had no evaluation, we conjecture that the difficulty of evaluating scenarios of ubiquitous and pervasive technology may have a role in this relatively high number of works without evaluation procedures. Regarding the categories identified for the evaluation subjects and methods, people's experience was the most highlighted subject of evaluation (34.6%), although it seems to be yet a concept open to further investigation among researchers, and interviews were the most practiced category of methods, summing up to 44.8% when added to questionnaires, revealing a predominance of self-reported data.

Lastly, results from the quality and relevance assessment show that the set of 80 selected entries

is comprised of documents with an average high quality with regard to our established quality parameters of the design process, methodology, practical application, evaluation, user participation, citations per year and h5-index of journal or conference. Furthermore, the selected entries were also considered of average high relevance for our systematic literature review, with the categories of interest of technology, interaction, embodiment, enactive, social, and interactive installation being relatively well-represented in most of the works. It is noticeable how the quality score is in most cases a little lower than the relevance score, but this can be explained by how our protocol and inclusion and exclusion criteria had a heavier emphasis on relevance, while quality was mostly assessed after the documents were already selected. Considering the combined score for quality and relevance, almost three quarters (73.75%) of the documents had a score higher than 0.6, which attests to the good quality and relevance of the set of 80 selected full-texts.

## 5 Conclusion

As computer use expands from well-defined and work-related tasks towards other areas of our lives, at all times, everywhere, and by everyone, it becomes increasingly important to have appropriate models and paradigms to understand current technological systems and their use, as well as to design future ones. By systematically investigating the literature on enaction, embodiment, and interactive installations, we can shed light on the subject and better inform current and future work of the museum scenario in the Socioenactive Systems project.

In this systematic literature review, we carefully explored a large set of documents. We identified 3245 documents with our search string in the four digital libraries we used, and through a strict protocol we ended up with 80 selected full-texts (roughly 2.46% of the found entries). We filled out a question form to collect data about these selected papers, such as general information (*e.g.*, authors, application context, design methodology, evaluation), and concepts directly related to our research questions grouped into six categories (Technology, Interaction, Embodiment, Enactive, Social, and Interactive installation). Preliminary results of the 80 selected documents revealed a relatively high number of researchers distributed between 22 countries, with documents being published in 57 different vehicles among journals, conference proceedings, and books. Regarding application context, we saw a preference for *in the wild* studies that took place within exhibition contexts, but there is also a relatively high number of studies that take place in controlled environments. Furthermore, a low number of documents conducted some evaluation in their studies (only 45). Lastly, our quality and relevance assessment reveal that the set of 80 selected documents show, on average, both high quality and relevance towards the topic of our systematic literature review.

Although these results already provide a valuable account of research on enaction and embodiment in interactive installations by highlighting the whos, wheres, and hows, they are yet preliminary and do not provide further insight into concepts related to our research questions and our six categories of interest. A thorough analysis of how these categories are present and connected to each other within the selected documents is the next step, with results to be published in a scientific journal yet to be determined. We further expect this analysis to be used in the museum scenario as both a way to examine past and current activities and proposed interactive systems, as well as to inform the design and application of future ones.

## Acknowledgements

This work is financially supported by the São Paulo Research Foundation (FAPESP) through grants #2015/16528-0, #2020/04242-2 and #2020/03503-7, the Coordenação de Aperfeiçoamento de Pes-

soal de Nível Superior – Brasil (CAPES) – Finance Code 001, and by the National Council for Scientific and Technological Development (CNPq) through grants #306272/2017-2 and #304708/2020-8. The opinions, hypotheses and conclusions or recommendations expressed in this material are the responsibility of the authors and do not necessarily reflect the views of FAPESP and the other funding agencies.

## References

- [1] BARANAUSKAS, M. C. C. O modelo semioparticipativo de design. In *Codesign de Redes Digitais: Tecnologia e Educação a Serviço da Inclusão Social*, M. Baranauskas, M. Martins, and J. Valente, Eds. Penso Editora, 2013.
- [2] BARANAUSKAS, M. C. C., AND BONACIN, R. Design—indicating through signs. *Design Issues* 24, 3 (2008), 30–45.
- [3] COSTELLO, B., AND EDMONDS, E. A study in play, pleasure and interaction design. In *Proceedings of the 2007 Conference on Designing Pleasurable Products and Interfaces* (New York, NY, USA, 2007), DPPI '07, Association for Computing Machinery, p. 76–91.
- [4] DOURISH, P. *Where the Action is: The Foundations of Embodied Interaction*. MIT Press, Cambridge, MA, USA, 2001.
- [5] DUARTE, E. F., AND BARANAUSKAS, M. C. C. An experience with deep time interactive installations within a museum scenario. Tech. Rep. IC-20-03, Institute of Computing, University of Campinas, March 2020.
- [6] DUARTE, E. F., MAIKE, V. R. M. L., HAYASHI, E. C. S., AND BARANAUSKAS, M. C. C. First steps towards socioenactive interactive art. Tech. Rep. IC-18-02, Institute of Computing, University of Campinas, March 2018.
- [7] DUARTE, E. F., MAIKE, V. R. M. L., MENDOZA, Y. L. M., DE LIMA TENÓRIO, C. V., AND BARANAUSKAS, M. C. C. A hands-on experience with interactive art within a museum scenario. Tech. Rep. IC-19-03, Institute of Computing, University of Campinas, March 2019.
- [8] GOUGH, D., OLIVER, S., AND THOMAS, J. *An Introduction to Systematic Reviews*. SAGE Publications, 2012.
- [9] KAIPAINEN, M., RAVAJA, N., TIKKA, P., VUORI, R., PUGLIESE, R., RAPINO, M., AND TAKALA, T. Enactive systems and enactive media: Embodied human-machine coupling beyond interfaces. *Leonardo* 44, 5 (Sep 2011), 433–438.
- [10] LIU, K. *Semiotics in Information Systems Engineering*. Cambridge University Press, New York, NY, USA, 2000.
- [11] MATURANA, H. Reflexiones: aprendizaje o deriva ontogenica. *Arch. Biol. Med. Exp* (1982), 261–71.
- [12] MATURANA, H. R., AND VARELA, F. J. *Autopoiesis and cognition: The realization of the living*, vol. 42. Springer Science & Business Media, 1991.

- [13] MENDOZA, Y. L. M., DUARTE, E. F., DE QUEIROZ, M. J. N., AND BARANAUSKAS, M. C. C. Evaluation within scenarios of ubiquitous and pervasive technology: A systematic literature review. Submitted for peer review, 2021.
- [14] MOHER, D., LIBERATI, A., TETZLAFF, J., ALTMAN, D. G., AND GROUP, T. P. Preferred reporting items for systematic reviews and meta-analyses: The prisma statement. *PLoS Medicine* 6, 7 (07 2009), 1–6.
- [15] VARELA, F., THOMPSON, E., AND ROSCH, E. *The Embodied Mind: Cognitive Science and Human Experience*. Cognitive science: Philosophy, psychology. MIT Press, 1993.
- [16] WEISER, M. The computer for the 21st century. *Scientific american* 265, 3 (1991), 94–104.

## Systematic Literature Review References

- [S1] ADHITYA, S., AND SCOTT, D. The london soundmap: Integrating sonic interaction design in the urban realm. In *Proceedings of the Audio Mostly 2018 on Sound in Immersion and Emotion* (New York, NY, USA, 2018), AM’18, Association for Computing Machinery.
- [S2] AFONSO, A. G., ERGIN, E., AND FATAH GEN. SCHIECK, A. Flowing bodies: Exploring the micro and macro scales of bodily interactions with urban media installations. In *Proceedings of the 2019 on Designing Interactive Systems Conference* (New York, NY, USA, 2019), DIS ’19, Association for Computing Machinery, p. 1183–1193.
- [S3] BATRAS, D., GUEZ, J., JÉGO, J.-F., AND TRAMUS, M.-H. A virtual reality agent-based platform for improvisation between real and virtual actors using gestures. In *Proceedings of the 2016 Virtual Reality International Conference* (New York, NY, USA, 2016), VRIC ’16, Association for Computing Machinery.
- [S4] BILORIA, N., AND DRITSA, D. *Real-Time Interactive Multimodal Systems for Physiological and Emotional Wellbeing*. Springer International Publishing, Cham, 2020, pp. 181–203.
- [S5] BROWN, C., AND PAINE, G. *A Case Study in Collaborative Learning via Participatory Music Interactive Systems: Interactive Tango Milonga*. Springer International Publishing, Cham, 2019, pp. 285–306.
- [S6] CANDAU, Y., SCHIPHORST, T., AND FRANÇOISE, J. *Designing from Embodied Knowing: Practice-Based Research at the Intersection Between Embodied Interaction and Somatics*. Springer International Publishing, Cham, 2018, pp. 203–230.
- [S7] CARAMIAUX, B., FRANÇOISE, J., SCHNELL, N., AND BEVILACQUA, F. Mapping through listening. *Computer Music Journal* 38, 3 (2014), 34–48.
- [S8] CECONELLO, M., AND SPALLAZZO, D. Vis-à-vis with Leonardo. Designing Digital Encounters. In *Eurographics Workshop on Graphics and Cultural Heritage* (2016), C. E. Catalano and L. D. Luca, Eds., The Eurographics Association.
- [S9] CERMAK-SASSENATH, D. *Makin’ Cake—Provocation, Self-confrontation, and the Opacity of Play*. Springer Singapore, Singapore, 2018, pp. 223–256.



- [S10] CHOI, K. Y., SUMINI, V., AND ISHII, H. Respire: Self-awareness and interpersonal connect- edness through shape-changing fabric display. In *Proceedings of the 2019 on Creativity and Cognition* (New York, NY, USA, 2019), C&C '19, Association for Computing Machinery, p. 449–454.
- [S11] CUAN, C., BERL, E., AND LAVIERS, A. Time to compile: A performance installation as human-robot interaction study examining self-evaluation and perceived control. *Paladyn, Journal of Behavioral Robotics* 10, 1 (01 Jan. 2019), 267–285.
- [S12] DAGAN, E. Co-located social engineering through novel technology design. In *Companion Publication of the 2020 ACM Designing Interactive Systems Conference* (New York, NY, USA, 2020), DIS' 20 Companion, Association for Computing Machinery, p. 503–508.
- [S13] DALSGAARD, P., DINDLER, C., AND HALSKOV, K. Understanding the dynamics of engaging interaction in public spaces. In *Human-Computer Interaction – INTERACT 2011* (Berlin, Heidelberg, 2011), P. Campos, N. Graham, J. Jorge, N. Nunes, P. Palanque, and M. Winckler, Eds., Springer Berlin Heidelberg, pp. 212–229.
- [S14] DUARTE, E. F., AND BARANAUSKAS, M. C. C. Revisiting interactive art from an interaction design perspective: Opening a research agenda. In *Proceedings of the 17th Brazilian Symposium on Human Factors in Computing Systems* (New York, NY, USA, 2018), IHC 2018, Association for Computing Machinery.
- [S15] DUARTE, E. F., GONÇALVES, F. M., AND BARANAUSKAS, M. C. C. Instint: Enacting a small-scale interactive installation through co-design. In *Proceedings of the 30th Australian Conference on Computer-Human Interaction* (New York, NY, USA, 2018), OzCHI '18, Association for Computing Machinery, p. 338–348.
- [S16] DUARTE, E. F., MENDOZA, Y. L. M., AND BARANAUSKAS, M. C. C. Instime: A case study on the co-design of interactive installations on deep time. In *Proceedings of the 2020 ACM Designing Interactive Systems Conference* (New York, NY, USA, 2020), DIS '20, Association for Computing Machinery, p. 231–242.
- [S17] ELLIS, R. Being-in-the-gallery. In *Extended Abstracts of the 2019 CHI Conference on Human Factors in Computing Systems* (New York, NY, USA, 2019), CHI EA '19, Association for Computing Machinery, p. 1–5.
- [S18] ERKUT, C., AND FEHR, J. Structuring design and evaluation of an interactive installation through swarms of light rays with human-artifact model. In *Interactivity, Game Creation, Design, Learning, and Innovation* (Cham, 2017), A. L. Brooks and E. Brooks, Eds., Springer International Publishing, pp. 39–46.
- [S19] FATAH GEN SCHIECK, A., AND MOUTINHO, A. M. Archi: Engaging with museum objects spatially through whole body movement. In *Proceeding of the 16th International Academic MindTrek Conference* (New York, NY, USA, 2012), MindTrek '12, Association for Computing Machinery, p. 39–45.
- [S20] FRAGA, T. Caracolomobile: affect in computer systems. *AI & SOCIETY* 28, 2 (May 2013), 167–176.
- [S21] FRANÇOISE, J., CANDAU, Y., FDILI ALAOU, S., AND SCHIPHORST, T. Designing for kines- thetic awareness: Revealing user experiences through second-person inquiry. In *Proceedings*

- of the 2017 CHI Conference on Human Factors in Computing Systems (New York, NY, USA, 2017), CHI '17, Association for Computing Machinery, p. 5171–5183.
- [S22] FRICH, J., MOSE BISKJAER, M., AND DALSGAARD, P. Twenty years of creativity research in human-computer interaction: Current state and future directions. In *Proceedings of the 2018 Designing Interactive Systems Conference* (New York, NY, USA, 2018), DIS '18, Association for Computing Machinery, p. 1235–1257.
- [S23] FROESE, T., SUZUKI, K., OGAI, Y., AND IKEGAMI, T. Using human-computer interfaces to investigate ‘mind-as-it-could-be’ from the first-person perspective. *Cognitive Computation* 4, 3 (Sept. 2012), 365–382.
- [S24] GRACE, K., GRACE, S., MAHER, M. L., MAHZOON, M. J., LEE, L., LOCURTO, L., AND OUTCAULT, B. The willful marionette: Exploring responses to embodied interaction. In *Proceedings of the 2017 ACM SIGCHI Conference on Creativity and Cognition* (New York, NY, USA, 2017), C&C '17, Association for Computing Machinery, p. 15–27.
- [S25] HALL, J. *An Autopoietic Aesthetic in Interactive Art*. Springer Netherlands, Dordrecht, 2015, pp. 297–314.
- [S26] HEBLING, E. D., PARTESOTTI, E., SANTANA, C. P., FIGUEIREDO, A., DEZOTTI, C. G., BOTECHIA, T., DA SILVA, C. A. P., DA SILVA, M. A., ROSSETTI, D., DE OLIVEIRA, V. A. W., CIELAVIN, S., MORONI, A. S., AND MANZOLLI, J. Moviescape: Audiovisual landscapes for silent movie: Enactive experience in a multimodal installation. In *Proceedings of the 9th International Conference on Digital and Interactive Arts* (New York, NY, USA, 2019), ARTECH 2019, Association for Computing Machinery.
- [S27] HOBYE, M., PADFIELD, N., AND LÖWGREN, J. Designing excuses for interaction to facilitate social curiosity. In *Proceedings of the 13th International Conference on the Foundations of Digital Games* (New York, NY, USA, 2018), FDG '18, Association for Computing Machinery.
- [S28] HSUEH, S., ALAOU, S. F., AND MACKAY, W. E. Understanding kinaesthetic creativity in dance. In *Proceedings of the 2019 CHI Conference on Human Factors in Computing Systems* (New York, NY, USA, 2019), CHI '19, Association for Computing Machinery, p. 1–12.
- [S29] INGEBRITSEN, R., KNOWLTON, C., SATO, H., AND MOTT, E. Social movements: A case study in dramaturgically-driven sound design for contemporary dance performance to mediate human-human interaction. In *Proceedings of the Fourteenth International Conference on Tangible, Embedded, and Embodied Interaction* (New York, NY, USA, 2020), TEI '20, Association for Computing Machinery, p. 227–237.
- [S30] JANAUSKAITUNDEFINED, L., AND PALAMAS, G. Establishing dialogues between movement and atmospheric ambiances. In *Proceedings of the 6th International Conference on Movement and Computing* (New York, NY, USA, 2019), MOCO '19, Association for Computing Machinery.
- [S31] KAPUR, J. Engaging with sense of smell through textile interactions. In *Distributed, Ambient and Pervasive Interactions* (Cham, 2019), N. Streitz and S. Konomi, Eds., Springer International Publishing, pp. 241–257.
- [S32] KELTON, M. L., AND MA, J. Y. Reconfiguring mathematical settings and activity through multi-party, whole-body collaboration. *Educational Studies in Mathematics* 98, 2 (June 2018), 177–196.

- [S33] KELTON, M. L., AND MA, J. Y. Assembling a torus: Family mobilities in an immersive mathematics exhibition. *Cognition and Instruction* 38, 3 (2020), 318–347.
- [S34] KENDERDINE, S., SHAW, J., AND GREMLER, T. *Cultural Data Sculpting: Omnidirectional Visualization for Cultural Datasets*. Springer London, London, 2013, pp. 199–220.
- [S35] KÖSTER, M., SCHMITZ, M., ZEHLE, S., AND DETZLER, B. Asterodrome: Force-of-gravity simulations in an interactive media theater. In *Entertainment Computing - ICEC 2015* (Cham, 2015), K. Chorianopoulos, M. Divitini, J. Baalsrud Hauge, L. Jaccheri, and R. Malaka, Eds., Springer International Publishing, pp. 359–366.
- [S36] KRYZHANIVSKA, O., AND BOYD, J. E. Body topography: Simulating human form. In *2012 IEEE International Symposium on Mixed and Augmented Reality - Arts, Media, and Humanities (ISMAR-AMH)* (2012), pp. 19–28.
- [S37] LEVINSKY, S., AND RUSSELL, A. Agency in dialogue: How choreographic thought emerges through dancing with tools that propel. In *2019 AISB Convention* (2019), The Society for the Study of Artificial Intelligence and Simulation of Behaviour, pp. 7–14.
- [S38] LIANG, R.-H., CHUNG, W.-M., KAO, H.-L., AND LIN, T.-Y. Intouch: Crossing social interaction with perception. In *Design, User Experience, and Usability. User Experience in Novel Technological Environments* (Berlin, Heidelberg, 2013), A. Marcus, Ed., Springer Berlin Heidelberg, pp. 306–315.
- [S39] LOKE, L., KHUT, G. P., AND KOCABALLI, A. B. Bodily experience and imagination: Designing ritual interactions for participatory live-art contexts. In *Proceedings of the Designing Interactive Systems Conference* (New York, NY, USA, 2012), DIS '12, Association for Computing Machinery, p. 779–788.
- [S40] LOPES, M. M. Body storytelling and the performance of memory: Arts-based-research and human enhancement. In *Distributed, Ambient and Pervasive Interactions* (Cham, 2016), N. Streitz and P. Markopoulos, Eds., Springer International Publishing, pp. 257–269.
- [S41] LUYTEN, T., BRAUN, S., VAN HOOREN, S., AND DE WITTE, L. Participant responses to physical, open-ended interactive digital artworks: A systematic review. *International Journal of Arts and Technology* 10, 2 (2017), 94–134.
- [S42] MALINVERNI, L., AND BURGUÈS, N. P. The medium matters: The impact of full-body interaction on the socio-affective aspects of collaboration. In *Proceedings of the 14th International Conference on Interaction Design and Children* (New York, NY, USA, 2015), IDC '15, Association for Computing Machinery, p. 89–98.
- [S43] MANN, S., JANZEN, R., HUANG, J., KELLY, M., BA, L. J., AND CHEN, A. User-interfaces based on the water-hammer effect: Water-hammer piano as an interactive percussion surface. In *Proceedings of the Fifth International Conference on Tangible, Embedded, and Embodied Interaction* (New York, NY, USA, 2010), TEI '11, Association for Computing Machinery, p. 1–8.
- [S44] MANZOLLI, J., MORONI, A., AND VALARINI, G. A. Selfhood: An evolutionary and interactive experience synthesizing images and sounds. In *Music Technology with Swing* (Cham, 2018), M. Aramaki, M. E. P. Davies, R. Kronland-Martinet, and S. Ystad, Eds., Springer International Publishing, pp. 625–636.

- [S45] MEHLER, A., LÜCKING, A., AND ABRAMI, G. Wikinect: image schemata as a basis of gestural writing for kinetic museum wikis. *Universal Access in the Information Society* 14, 3 (Aug. 2015), 333–349.
- [S46] MENDOZA, Y. L. M., AND BARANAUSKAS, M. C. C. Tangitime: Designing a (socio)enactive experience for deep time in an educational exhibit. In *Proceedings of the 18th Brazilian Symposium on Human Factors in Computing Systems* (New York, NY, USA, 2019), IHC '19, Association for Computing Machinery.
- [S47] MILLAR, G. C., TABRIZIAN, P., PETRASOVA, A., PETRAS, V., HARMON, B., MITASOVA, H., AND MEETENMEYER, R. K. Tangible landscape: A hands-on method for teaching terrain analysis. In *Proceedings of the 2018 CHI Conference on Human Factors in Computing Systems* (New York, NY, USA, 2018), CHI '18, Association for Computing Machinery, p. 1–12.
- [S48] MOK, S., JEON, J., HAYES, M. H., AND PAIK, J. Participating interface. In *SIGGRAPH Asia 2013 Art Gallery* (New York, NY, USA, 2013), SA '13, Association for Computing Machinery.
- [S49] MORA-GUIARD, J., CROWELL, C., AND PARES, N. A play therapy based full-body interaction intervention tool for children with autism. In *Pervasive Computing Paradigms for Mental Health* (Cham, 2018), N. Oliver, S. Serino, A. Matic, P. Cipresso, N. Filipovic, and L. Gavrilovska, Eds., Springer International Publishing, pp. 28–40.
- [S50] MORA-GUIARD, J., AND PARES, N. "child as the measure of all things": The body as a referent in designing a museum exhibit to understand the nanoscale. In *Proceedings of the 2014 Conference on Interaction Design and Children* (New York, NY, USA, 2014), IDC '14, Association for Computing Machinery, p. 27–36.
- [S51] MORGAN, E., AND GUNES, H. Human nonverbal behaviour understanding in the wild for new media art. In *Human Behavior Understanding* (Cham, 2013), A. A. Salah, H. Hung, O. Aran, and H. Gunes, Eds., Springer International Publishing, pp. 27–39.
- [S52] NOVAKOVIC, G. *Fugue and Variations on Some Themes in Art and Science*. Springer London, London, 2013, pp. 105–118.
- [S53] NÚÑEZ PACHECO, C., AND LOKE, L. Aesthetic resources for technology-mediated bodily self-reflection: The case of eloquent robes. In *Proceedings of the 26th Australian Computer-Human Interaction Conference on Designing Futures: The Future of Design* (New York, NY, USA, 2014), OzCHI '14, Association for Computing Machinery, p. 1–10.
- [S54] PENNY, S. Emergence, agency, and interaction—notes from the field. *Artificial Life* 21, 3 (2015), 271–284. PMID: 26280067.
- [S55] PRICE, S. *Digital Museum Installations: The Role of the Body in Creativity*. Palgrave Macmillan UK, London, 2017, pp. 221–234.
- [S56] PRPA, M., TATAR, K., RIECKE, B. E., AND PASQUIER, P. The pulse breath water system: Exploring breathing as an embodied interaction for enhancing the affective potential of virtual reality. In *Virtual, Augmented and Mixed Reality* (Cham, 2017), S. Lackey and J. Chen, Eds., Springer International Publishing, pp. 153–172.

- [S57] RAMCHURN, R. Brain controlled cinema. In *Proceedings of the 30<sup>th</sup> International BCS Human Computer Interaction Conference, HCI 2016* (2016), vol. 2016-July, BCS Learning and Development Ltd., pp. 1–6.
- [S58] ROBERTS, J., AND LYONS, L. The value of learning talk: applying a novel dialogue scoring method to inform interaction design in an open-ended, embodied museum exhibit. *International Journal of Computer-Supported Collaborative Learning* 12, 4 (Dec. 2017), 343–376.
- [S59] SALMON, R., AND PAINE, G. Embodiment: Auditory visual enhancement of interactive environments. In *Proceedings of the 7<sup>th</sup> International Conference on Tangible, Embedded and Embodied Interaction* (New York, NY, USA, 2013), TEI '13, Association for Computing Machinery, p. 129–136.
- [S60] SALTER, C. Disturbance, translation, enculturation: Necessary research in new media, technology, and the senses. *Visual Anthropology Review* 34, 1 (2018), 87–97.
- [S61] SCHACHER, J. C., AND BISIG, D. Haunting space, social interaction in a large-scale media environment. In *Human-Computer Interaction - INTERACT 2017* (Cham, 2017), R. Bernhaupt, G. Dalvi, A. Joshi, D. K. Balkrishan, J. O'Neill, and M. Winckler, Eds., Springer International Publishing, pp. 242–262.
- [S62] SCHIPHORST, T. Self-evidence: Applying somatic connoisseurship to experience design. In *CHI '11 Extended Abstracts on Human Factors in Computing Systems* (New York, NY, USA, 2011), CHI EA '11, Association for Computing Machinery, p. 145–160.
- [S63] SEARCH, P. Multisensory physical environments for data representation. In *Design, User Experience, and Usability: Technological Contexts* (Cham, 2016), A. Marcus, Ed., Springer International Publishing, pp. 202–213.
- [S64] SHAER, O., VALDES, C., LIU, S., LU, K., CHANG, K., XU, W., HADDOCK, T. L., BHATIA, S., DENSMORE, D., AND KINCAID, R. Designing reality-based interfaces for experiential bio-design. *Personal and Ubiquitous Computing* 18, 6 (Aug. 2014), 1515–1532.
- [S65] SHELLARD, M., OLIVEIRA, L. F., FORNARI, J. E., AND MANZOLLI, J. *Abduction and Meaning in Evolutionary Soundscapes*. Springer Berlin Heidelberg, Berlin, Heidelberg, 2010, pp. 407–427.
- [S66] SIMON, L. U., VAN DER VLUGT, M., AND CALVI, L. Triggers to entice an audience to 'perform as interface' in an interactive installation. In *Proceedings of the 20<sup>th</sup> International Academic Mindtrek Conference* (New York, NY, USA, 2016), AcademicMindtrek '16, Association for Computing Machinery, p. 322–330.
- [S67] STEPANOVA, E. R., DESNOYERS-STEWART, J., PASQUIER, P., AND RIECKE, B. E. Jel: Breathing together to connect with others and nature. In *Proceedings of the 2020 ACM Designing Interactive Systems Conference* (New York, NY, USA, 2020), DIS '20, Association for Computing Machinery, p. 641–654.
- [S68] TAN, L. A methodology for designing meaningful interactions in public space. In *Advances in Industrial Design* (Cham, 2020), G. Di Bucchianico, C. S. Shin, S. Shim, S. Fukuda, G. Montagna, and C. Carvalho, Eds., Springer International Publishing, pp. 920–926.

- [S69] TAN, L., AND CHOW, K. K. N. Facilitating meaningful experience with ambient media: An embodied engagement model. In *Proceedings of the Fifth International Symposium of Chinese CHI* (New York, NY, USA, 2017), Chinese CHI 2017, Association for Computing Machinery, p. 36–46.
- [S70] TANAKA, A. *BioMuse to Bondage: Corporeal Interaction in Performance and Exhibition*. Palgrave Macmillan UK, London, 2012, pp. 159–169.
- [S71] TANENBAUM, K., HATALA, M., TANENBAUM, J., WAKKARY, R., AND ANTLE, A. A case study of intended versus actual experience of adaptivity in a tangible storytelling system. *User Modeling and User-Adapted Interaction* 24, 3 (Aug. 2014), 175–217.
- [S72] TIKKA, H., NA, S. V., JACUCCI, G., AND KORPILAHTI, T. Provoking the city–touch installations for urban space. *Digital Creativity* 22, 3 (2011), 200–214.
- [S73] TOMÁS, E. Tangible scores. In *Proceedings of the TEI '16: Tenth International Conference on Tangible, Embedded, and Embodied Interaction* (New York, NY, USA, 2016), TEI '16, Association for Computing Machinery, p. 669–674.
- [S74] TORPUS, J. Extending museum exhibits by embedded media content for an embodied interaction experience. In *Proceedings of the 10th Nordic Conference on Human-Computer Interaction* (New York, NY, USA, 2018), NordiCHI '18, Association for Computing Machinery, p. 236–246.
- [S75] VETS, T., NIJS, L., LESAFFRE, M., MOENS, B., BRESSAN, F., COLPAERT, P., LAMBERT, P., VAN DE WALLE, R., AND LEMAN, M. Gamified music improvisation with billiard: a multimodal installation with balls. *Journal on Multimodal User Interfaces* 11, 1 (Mar. 2017), 25–38.
- [S76] VIDYARTHI, J., RIECKE, B. E., AND GROMALA, D. *sonic cradle*: Designing for an immersive experience of meditation by connecting respiration to music. In *Proceedings of the Designing Interactive Systems Conference* (New York, NY, USA, 2012), DIS '12, Association for Computing Machinery, p. 408–417.
- [S77] VOLPE, G., AND CAMURRI, A. A system for embodied social active listening to sound and music content. *J. Comput. Cult. Herit.* 4, 1 (Aug. 2011).
- [S78] WARD, R. M., AND HENNESSY, K. *(Ukulele) Strings of Knowledge: Tactile and Digital Interactivity with Archives and Ethnography*. Springer International Publishing, Cham, 2018, pp. 125–149.
- [S79] WIETHOFF, A., GERSTBERGER, J., AND GEHRING, S. Starlight: Exploring embodied interactions with media architecture and public audiences. In *Proceedings of the 4th International Symposium on Pervasive Displays* (New York, NY, USA, 2015), PerDis '15, Association for Computing Machinery, p. 83–89.
- [S80] XAMBÓ, A., HORNECKER, E., MARSHALL, P., JORDÀ, S., DOBBYN, C., AND LANEY, R. Exploring Social Interaction With a Tangible Music Interface. *Interacting with Computers* 29, 2 (06 2016), 248–270.

# Appendices

## A Form for the Description of Study Characteristics

The form presented in this appendix is a print version generated by Google Forms. In our study the form was filled in digital form, but had the exact same instructions, questions, descriptions and options. Furthermore, the form is presented in the Brazilian Portuguese language as we, the authors, created and filled it in this language.

# RSL Sistemas Socioenativos: Mapeamento

Formulário específico do GT: Museu

O campo e-mail abaixo é obrigatório para garantir o envio da confirmação de preenchimento. Caso você precise editar a repostas após a submissão, há uma opção de editar respostas na mensagem de confirmação (tanto no próprio navegador, logo após, quanto no e-mail de confirmação enviado).

\* Required

1. Email address \*

---



**2. Trabalho Analisado \***

Número (#ID) do trabalho analisado.

*Mark only one oval.*

- #13
- #65
- #248
- #264
- #293
- #295
- #342
- #354
- #412
- #444
- #460
- #474
- #482
- #497
- #527
- #543
- #549
- #563
- #564
- #599
- #608
- #609
- #615
- #620
- #632
- #780
- #818
- #967
- #1047
- #1095
- #1105

- #1130
- #1167
- #1237
- #1247
- #1322
- #1323
- #1355
- #1367
- #1407
- #1415
- #1420
- #1495
- #1549
- #1597
- #1622
- #1738
- #1756
- #1770
- #1771
- #1773
- #1828
- #1879
- #1891
- #1918
- #1931
- #1959
- #1974
- #2027
- #2034
- #2071
- #2156
- #2161
- #2233
- #2280
- #2285

- #2307
- #2353
- #2409
- #2411
- #2432
- #2461
- #2484
- #2490
- #2603
- #2604
- #2633
- #2715
- #2724
- #2753
- #2804

### 1. Informações Gerais

Informações gerais sobre o artigo, comuns em qualquer revisão sistemática da literatura.

#### 3. 1.1 País de Afiliação dos Autores \*

Em qual país ou países estão as instituições dos autores? Em "Outros", separar países por vírgula.

*Check all that apply.*

- Estados Unidos da América
- Canadá
- Reino Unido
- Alemanha
- França
- Austrália
- China
- Brasil

Other:  \_\_\_\_\_

## 4. 1.2 Tipo de Instituição \*

De acordo com a instituição dos mesmos, os autores são da academia, indústria, governo, ou outros?

*Check all that apply.*

Academia

Iniciativa Privada

Governo

Other:  \_\_\_\_\_

## 5. 1.3 Contexto de Aplicação \*

Qual é o contexto de aplicação do trabalho, incluindo o tipo de espaço físico no qual ele se situa? (e.g., educacional, escola, museu, saúde, hospital, entretenimento etc.)

\_\_\_\_\_

## 6. 1.4 Público-alvo \*

O estudo especifica um público-alvo e/ou perfil dos participantes? Se sim, qual? Se necessário, utilizar o campo "Outros" para especificar melhor (e.g., entre 7 e 10 anos, hospitalizadas etc.), ou para informar que não é especificado.

*Check all that apply.*

Crianças

Adolescentes

Adultos

Other:  \_\_\_\_\_

## 7. 1.5 Metodologia \*

Qual a metodologia de pesquisa adotada pelo estudo? Marque todas as opções que se apliquem, e o campo "Outro" com um detalhamento da resposta e/ou opções não presentes (identificar o que é detalhamento entre colchetes "[...]" e o que é nova opção entre parênteses "(...)").

*Check all that apply.*

Qualitativa

Quantitativa

Estudo de Caso

Experimental

Survey (Questionário)

Revisão Sistemática da Literatura

Other:  \_\_\_\_\_

**8. 1.6 Design \***

O estudo envolve o design de algum artefato e/ou sistema? Se sim, qual a metodologia de design? (e.g., design participativo, ad-hoc etc.) Marque todas as opções que se apliquem, e o campo "Outro" com um detalhamento da resposta e/ou opções não presentes (identificar o que é detalhamento entre colchetes "[...]" e o que é nova opção entre parênteses "(...)").

*Check all that apply.*

- Co-design
- Design Participativo
- Prototipação
- Design Semioparticipativo

Other:  \_\_\_\_\_

**9. 1.7 Avaliação (What) \***

O estudo possui avaliação? Se sim, o que é avaliado?

*Check all that apply.*

- Artefatos e Dispositivos
- Experiência das Pessoas
- Cenário (Pessoas e Artefatos)
- Interação

Other:  \_\_\_\_\_

**10. 1.8 Avaliação (How) \***

Quais os métodos e/ou instrumentos utilizados, quem são os participantes? (e.g., avaliação heurística, teste de usabilidade, AttrakDiff, SAM etc.) Marque todas as opções que se apliquem, e o campo "Outro" com um detalhamento da resposta e/ou opções não presentes (identificar o que é detalhamento entre colchetes "[...]" e o que é nova opção entre parênteses "(...)").

*Check all that apply.*

- Análise de Vídeo
- Análise Automática
- Questionário
- Entrevista

Other:  \_\_\_\_\_

**2. Categorias Conceituais**

Categorias relacionadas ao conceito de sistema socioenativo.

### 11. 2.1 Technology \*

Quais descritores abaixo descrevem o uso de tecnologia no artigo? Marque todas as opções que se apliquem, e o campo "Outro", se necessário, com um detalhamento da resposta e/ou opções não presentes (identificar o que é detalhamento entre colchetes "[...]" e o que é nova opção entre parênteses "...").

*Check all that apply.*

- Actuator: Dispositivos de saída (LEDs, motores etc.)
- Microcontroller: Computadores embutidos, como Arduino, Raspberry Pi etc.
- Display: TVs, Projetores, Painéis de LED etc.
- Embedded: Tecnologias embarcadas, embutidas em algo
- NUI: Tecnologias de interfaces naturais, como Kinect e derivados
- Robotics: Uso de robôs, como o mBot
- Sensor: Dispositivos de entrada, proximidade, cor, toque, microfone, câmera, oxímetro
- Tabletop: Mesa interativa com display embutido e outros dispositivos tangíveis
- Tangible: Informação digital concretizada pela manipulação de objetos físicos
- Wearable: Tecnologias vestíveis, como roupas e acessórios inteligentes
- Wireless: Tecnologias de comunicação sem fio, como Wi-Fi e Bluetooth

Other:  \_\_\_\_\_

### 12. 2.2 Interaction \*

Quais descritores abaixo descrevem a interação com a tecnologia no artigo? Marque todas as opções que se apliquem, e o campo "Outro", se necessário, com um detalhamento da resposta e/ou opções não presentes (identificar o que é detalhamento entre colchetes "[...]" e o que é nova opção entre parênteses "...").

*Check all that apply.*

- Embodied Interaction: Uso do corpo de forma natural e significativa (vide Dourish)
- Full-body Interaction: Interação que envolve o uso do corpo de forma completa
- Gaze: Interação por meio do olhar (eyetracking)
- Gesture: Interação por meio de gestos, intencional
- Motion: Interação por meio de movimento, não necessariamente intencional
- Physiological Information: Interação por meio de dados fisiológicos (ECG, HR, GSR)
- Tangible Interaction: Interação (toque, abraço, etc.) por meio de objetos físicos
- Voice: Interação por meio do uso da voz

Other:  \_\_\_\_\_

## 13. 2.3 Embodiment \*

Quais descritores abaixo descrevem o uso do conceito de embodiment no artigo? Marque todas as opções que se apliquem, e o campo "Outro", se necessário, com um detalhamento da resposta e/ou opções não presentes (identificar o que é detalhamento entre colchetes "[...]" e o que é nova opção entre parênteses "(...)").

*Check all that apply.*

- Bodily Actions: Ação corporal (batimento cardíaco, posição da cabeça, olhos etc.)
- Body Movements: Qualquer tipo de movimento do corpo, como braços, pernas etc.
- Embodied Action: Ação perceptualmente guiada (Varela et al.)
- Embodied Cognition (EC): Cognição não contida apenas no cérebro, envolve o corpo
- Embodied Interaction: Uso do corpo de forma natural e significativa (vide Dourish)
- Full-body Interaction: Interação que envolve o uso do corpo de forma completa

Other:  \_\_\_\_\_

## 14. 2.4 Enactive \*

Quais descritores abaixo descrevem o uso do conceito de enação no artigo? Marque todas as opções que se apliquem, e o campo "Outro", se necessário, com um detalhamento da resposta e/ou opções não presentes (identificar o que é detalhamento entre colchetes "[...]" e o que é nova opção entre parênteses "(...)").

*Check all that apply.*

- Action: Ato de agir sobre o mundo, fundamentalmente inseparável de percepção
- Autopoiesis: Capacidade de organismos de produzirem a si próprios (Maturana)
- Embodied Cognition (EC): Cognição não contida apenas no cérebro, envolve o corpo
- Embodied Mind: Cognição como corpo e mente interdependentes (Varela et al.)
- Sense-Making: Formação de significados (sentido) por meio de interações
- Ontogenetic Drift: Aprendizado como mudança constante, uma história (Maturana)
- Perception: Ato de perceber o mundo, fundamentalmente inseparável de ação

Other:  \_\_\_\_\_

### 15. 2.5 Social \*

Quais descritores abaixo descrevem aspectos sociais presentes no artigo? Marque todas as opções que se apliquem, e o campo "Outro", se necessário, com um detalhamento da resposta e/ou opções não presentes (identificar o que é detalhamento entre colchetes "[...]" e o que é nova opção entre parênteses "...").

*Check all that apply.*

- Social Awareness: Consciência da influência de outros e sobre outros
- Collaboration: Colaboração/participação/cooperação para resolver um problema
- Competition: Competição entre duas ou mais pessoas (e.g., jogo competitivo)
- Conversation: Uso de linguagem para comunicação (voz, gestos, expressões etc.)
- Coordination: Ações coordenadas entre diferentes pessoas, podendo existir liderança
- Group Behavioral Changing: Mudança de comportamento por interação social
- Group Interaction: Dinâmica com a qual membros de um grupo interagem entre si
- Social Fiction: Imaginar, de forma social, realidades alternativas ou possíveis futuros
- Social Interaction: Processo de influência mútua entre pessoas

Other:  \_\_\_\_\_

### 16. 2.6 Interative Installation \*

Quais descritores abaixo descrevem o tipo de instalação interativa presente no artigo? Marque todas as opções que se apliquem, e o campo "Outro", se necessário, com um detalhamento da resposta e/ou opções não presentes (identificar o que é detalhamento entre colchetes "[...]" e o que é nova opção entre parênteses "...").

*Check all that apply.*

- Art Installation: Ênfase artística, como estética (conceito filosófico) e experiência
- Cinema Installation: Explora o conceito e o espaço físico de um cinema
- Educational Installation: Possui foco educacional, talvez até em contexto educacional
- Emotional Installation: Foco em detectar ou permitir a expressão de emoções
- Enactive Installation: Possui um grau de autonomia (Varela et al.)
- Multimodal Installation: Diferentes modos de interação e entrada e saída de dados
- Music/sound Installation: Foco em música e/ou sonoridade de forma geral
- Playful Installation: Foco no lúdico, divertido, em brincadeiras (Costello e Edmonds)
- Public Space/Installation: Localizada em espaços públicos e de livre circulação
- Tangible Installation: Foco na interação por meio do manuseio de objetos físicos
- Wearable Installation: Artefatos que podem ser vestidos como parte da instalação

Other:  \_\_\_\_\_

## 3. Considerações Finais

Outras categorias e descritores que podem ser objeto de análise na revisão.



17. 3.1 Outras Categorias e Descritores

Quais conceitos, tecnologias etc. relevantes, não contemplados neste formulário, aparecem no artigo?

---

---

---

---

---

18. 3.2 Considerações Gerais

Quer fazer algum comentário ou observação geral sobre o artigo?

---

---

---

---

---

---

This content is neither created nor endorsed by Google.

Google Forms