

From Barriers to Inclusion: A Female-Inclusive Assessment Framework for Interface Evaluation

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Abstract. *Considering the gender disparities affecting the use and interaction with technological systems, females often face barriers. In terms of self-efficacy, for example, they commonly exhibit lower levels. This discrepancy, when translated to interface design, may pose a hurdle to female usage, particularly with more complex designs. To promote inclusivity, the ATIV framework was proposed to evaluate how female-inclusive a technology is. The framework includes an assessment instrument developed using feminist HCI values and contextual factors impacting women in technology. Empirical studies testing both the framework and the instrument revealed increased empathy among HCI specialists toward feminist and inclusive values in interface design.*

1. Introduction

The pervasive integration of technology into contemporary society over the past decades has made technological devices indispensable. However, the uniformity of interaction with technology is not experienced equally by all individuals, as some encounter obstacles in universal implementations. When contemplating inclusive design, Intersectional Human-Computer Interaction (HCI) [Schlesinger et al. 2017] emphasizes the importance of considering diverse aspects in HCI research and design, such as gender, race, and class.

Specifically addressing gender, research indicates gender differences in technology interaction, which affect self-efficacy perception and create barriers to female success in utilizing certain features [Brewer and Bassoli 2006, Burnett 2010]. This poses a hindrance to female technology use, necessitating attention to ensure technology inclusivity.

Given these considerations, this work presents a framework for HCI evaluation, influenced by usability inspection methods, but with a focus on female inclusivity. This involves integrating feminist HCI values and considering contextual factors that shape the relationship between gender and the use, interaction, and design of interactive systems.

2. Feminist HCI and Human Values

The concept of Feminist HCI [Bardzell 2010] outlines a set of feminist interaction design values (or qualities) aimed at integrating feminism into the processes of design, research, and evaluation. Given the perceived conservatism of traditional HCI, the central idea was to prompt reflection on addressing and mitigating the persistent issue of marginalization affecting women and other minority groups in technology. While influenced by feminist

theory, the suggested values were not necessarily unique to feminism; instead, they were already acknowledged in various forms within the HCI literature. These values encompass:

- **Pluralism:** Refers to denaturalizing normative conventions about the “universal user” and actively working with diversity.
- **Participation:** Values participatory engagement throughout the design process, regardless of one’s background, status, or technical knowledge.
- **Advocacy:** Entails seeking progressive solutions in design and questioning the existing status quo.
- **Ecology:** Considers ways in which relationships among artifacts determine their meaning within the system or ecology.
- **Embodiment:** Focuses on an embodied user, acknowledging their gender differences and identity, human sexuality, pleasure and desire, emotions, motivating drives and primal urges.
- **Self-disclosure:** Pertains to making visible to users the ways in which software affects them.

3. Development of the Instrument

A systematic mapping study investigated the contextual factors influencing the inclusion and permanence of women in technology [Drummond et al. 2023]. The study identified 8 categories of contextual factors: individual, interpersonal, academic, laboral, family-related, socioeconomic, social, and historical. These categories encompass a total of 196 factors, classified based on their impact (positive or negative), thereby depicting which factors either enable or constrain the development of women’s careers in technology.

To validate the mapping and standardize the results, a series of steps were undertaken (Figure 1). The process began with a reanalysis of the papers included in the mapping to confirm the previously identified contextual factors and incorporate any that were overlooked. As a result, the number of factors increased from 196 to 267.

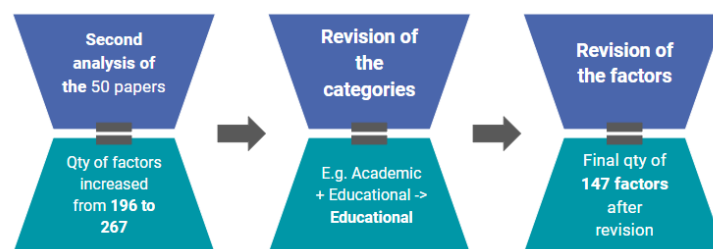


Figure 1. Standardization process

Subsequently, categories and contextual factors with similar or ambiguous semantics were merged into unified categories with consistent meanings. This process resulted in the final 8 categories: Educational, Family-related, Historical, Individual, Interpersonal, Professional, Sociocultural, and Socioeconomic. It also culminated in a refined compilation comprising 147 distinct contextual factors (Figure 2).

With the revised compilation of factors in hand, the next step entailed matching the contextual factors with feminist HCI values. The contextual factors under the “Indi-

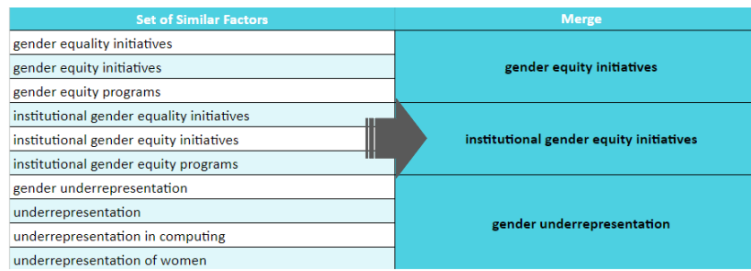


Figure 2. Revision of factors

vidual” category were chosen, given the intention to construct an instrument for assessing technologies based on values deeply rooted in personal perceptions.

To understand how each contextual factor aligned with a feminist HCI value, pairing questions were formulated (e.g., *Pluralism: Does the contextual factor encourage an engagement with diversity and cultural difference, denaturalizing normative conventions and rejecting universalism?*). Each contextual factor was evaluated using all pairing questions. A positive response signified alignment between the factor and the value.

| Contextual Factor | Pluralism | Participation | Advocacy | Ecology | Embodiment | Self-disclosure |
|-----------------------------------|-------------------------------------|-------------------------------------|-------------------------------------|-------------------------------------|-------------------------------------|-------------------------------------|
| Difficulty in computer tools use | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Ethnicity | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| Exposure to technology | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Extraversion | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| Gender | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| Gender bias | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Health issues | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| Honesty | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| Impostor syndrome | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Lack of knowledge about the field | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Lack of self-confidence | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Lack of self-efficacy | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Leadership skills development | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Management of complexity | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Mental exhaustion | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| Prove-it-again bias | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Purpose of Use | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| Self-confidence | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Self-efficacy | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Self-Limitations | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Sense of Identity | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| Sense of no belonging | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Technical skills | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Unconscious bias | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Work ethic | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |

Figure 3. Matching of the individual contextual factors and HCI values

The consecutive phase was the actual construction of the instrument. The instrument was divided into six sections, each corresponding to a distinct feminist HCI value, with their assessment items derived from contextual factors. The formulation of the assessment items proceeded through three stages:

1. A reflection on each value’s core idea was undertaken (e.g., **Pluralism**: consideration of diversity).
2. Building upon the core idea of each value, a question regarding the impact of the value on design was posed (e.g., **Pluralism**: Is the design/interface plural and diverse? Does it incorporate features for diverse users?).

3. A more in-depth question was developed, considering the factor's impact on design within the context of the core idea (e.g., **Ethnicity factor within Pluralism value**: Does the design/interface exhibit sensitivity to individuals of different ethnicity? Is the language used inclusive in terms of ethnicity?).

These items underwent a transformation from a question format to a first-person declaration, facilitating later evaluation through the utilization of a Likert scale (1-5 scale, where 1 means 'Totally disagree' and 5 means 'Totally agree').

4. Empirical Studies

The empirical studies were planned to validate the developed instrument and to understand its applicability in the conscious design of new technologies. The instrument was primarily designed as a tool for HCI specialists to support the HCI evaluation phase, with a focus on enhancing the quality of interaction while avoiding the perpetuation of women's marginalization. The research questions that guided the studies are defined below:

- **RQ1.** How does the instrument encourage (or not) the discussion about feminist and inclusive values in the interaction design?
- **RQ2.** What are the facilities and difficulties posed during the use of the instrument?

4.1. Pilot Study

A moderated pilot study was conducted with a focus group of 5 participants (3 female and 2 male, with prior knowledge in HCI). The focus group aimed to evaluate two portals (UNESCO¹ and OECD²) incorporating feminist HCI values. To facilitate understanding, these values were succinctly presented before the activity. Participants were then assigned tasks to engage with the portals, followed by a questionnaire (containing the instrument) to evaluate the interaction, concluding with a discussion.

The estimated duration for the pilot study was one hour; however, the total elapsed time amounted to 1 hour and a half. During the discussion, some participants struggled to connect with the feminist HCI values, focusing more on usability issues and encountering difficulties in evaluating the platforms with the values in mind. This feedback was essential for refining preparations for the primary study.

4.2. Study #1

After the pilot study, adjustments were made to the script and preparations for the primary study. Another questionnaire was crafted, introducing a persona/scenario for each feminist HCI value. With these modifications, another focus group was conducted with 5 additional participants (2 female and 3 male, with prior knowledge in HCI). The portals evaluated were the same as those in the pilot study. The modifications enabled the study's completion within the estimated time frame (1 hour and a half) and improved discussion fluidity, allowing participants to connect with feminist HCI values and recognize their presence or absence in the interface interaction.

¹<https://www.unesco.org>

²<https://www.oecd.org/>

4.3. Study #2

After facilitating improved participant engagement with the instrument, a final study was devised with 4 recruited participants (3 females and 1 male, all with prior knowledge in HCI). For this study, it was presented a framework named ATIV (Assessment of Technology based on Feminist and Inclusive Values). This framework is proposed for HCI evaluation and includes an inspection planning, an interactive assessment instrument, and a template for reporting results. The instructions for utilization are divided into four steps, as portrayed in Figure 4.

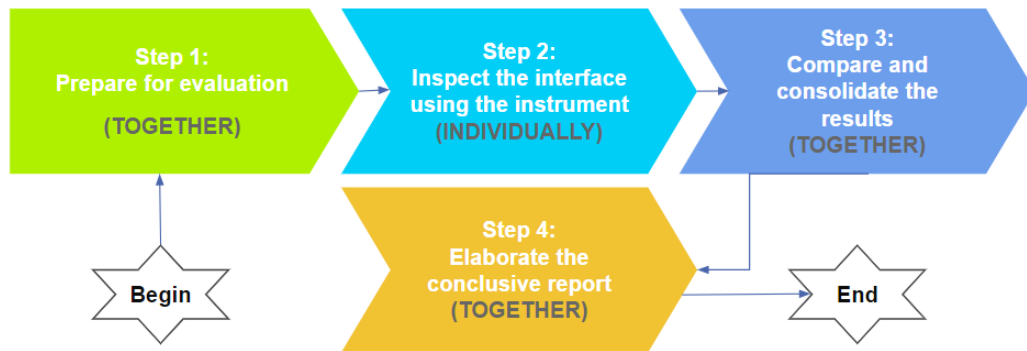


Figure 4. Framework instructions

Participants were instructed to perform the evaluation without supervision, using the interactive assessment instrument (Figure 5) and the tools provided by the framework. They were free to build the personas and choose the portals to evaluate. Following the evaluation, a meeting was convened to compile results and gather participants' perceptions regarding the instrument's utility and any difficulties encountered.

Assessment of Technology based on Feminist and Inclusive Values

In order to add new task columns, click the button below: [Add task](#)

| Values | Contextual Factors | ID | Items | Task |
|-------------------------|---|-----|--|------|
| Perceived Pluralism | Perceived ethnicity sensitivity | I01 | Does the interface exhibit sensitivity to individuals of different ethnicity? | ▼ |
| | Perceived extraversion sensitivity | I02 | Is the language used inclusive in terms of ethnicity? | ▼ |
| | Perceived gender sensitivity | I03 | Does the language used talk to everybody or only to dominant groups? | ▼ |
| | Perceived sense of belonging | I04 | Does the interface exhibit sensitivity to individuals of different gender? | ▼ |
| | Perceived digital skills | I05 | Is the language used inclusive in terms of gender? | ▼ |
| | Perceived technical knowledge | I06 | Does the interface and language used provide a sense of belonging? | ▼ |
| Perceived Participation | Perceived contextualization | I07 | Is the navigation through the interface smooth regardless of the level of digital skills? (Digital skills: Proficiency in using computers for digital media, internet, online communication, etc.) | ▼ |
| | Perceived leadership development | I08 | Is the navigation through the interface smooth regardless of technical knowledge? (Technical knowledge: Proficiency in specific tools, as well as in-depth knowledge of software or hardware.) | ▼ |
| | Perceived management of complex social skills | I09 | Does the interface provide adequate context to enable use without prior knowledge? | ▼ |
| | | I10 | Does the interface encourage collaboration of individuals regardless their leadership skills? | ▼ |
| | | I11 | Does the interface provide resources to support individuals who want to develop their leadership skills? | ▼ |
| | | I12 | Does the interface encourage collaboration of individuals regardless their social skills? | ▼ |
| | | I13 | Does the interface provide resources to support individuals who want to develop their social skills? | ▼ |

Figure 5. Fragment of the interactive assessment instrument

Several measures were implemented to ensure the ethical integrity of this research, including voluntary participation, informed consent, anonymity, confidentiality, assessment of potential harm, and communication of results. These measures align with the standards in the Regulatory Guidelines for Research Involving Human Subjects – Resolution CNS no. 466/2012. The project was also submitted for approval by the Ethics Committee under the registration number CAAE No. 66296922.6.0000.5690.

5. Results and Discussions

After conducting the studies, the collected data were categorized and analyzed to address the research questions. Data collection involved recording focus groups, which were later transcribed and categorized using the Grounded Theory [Corbin et al. 1990], a bottom-up approach through which theory emerges directly from the data.

Details about the instrument development process, scripts/personas/tools used on the empirical studies, framework details (interactive instrument, reporting template) and results can be found on the repository of the project³.

5.1. RQ1. How does the instrument encourage (or not) the discussion about feminist and inclusive values in the interaction design?

When gathering evidence regarding the utility of the instrument in fostering reflections and discussions about feminist and inclusive values in interaction design, two main categories were identified: **C01. Talked about the Values** and **C02. Deviated from the Values**. Under the first category, participants engaged in discussions related to various feminist and inclusive issues while interacting with the portals. Key themes included **Mental Fatigue**, **Purpose of the Website**, **Advanced/Customized Features**, **Sense of Detachment**, **Sense of Belonging**, and **Diverse Users**. One example of difficulty related to **Mental Fatigue**, was the *Complexity in presenting information*, as expressed by one of the participants:

“We also considered the issue of some of the ways information is presented being somewhat complex. So, we observed, for example, that there are many graphics throughout the interface, and they are not very common, thus not very straightforward to understand. Therefore, we also regarded this as a significant problem because it would not assist people in interpreting correctly.”

The second category encompassed elements in the process that disrupted evaluation and diverted participants from examining these values in interactions, focusing instead on issues such as **Interface Appearance**, **Interface Elements or Organization**, and **Type of Results**. Participants stated, for example, that the interface was *Non-intuitive*, as follows:

“So, I think the website itself, as I mentioned in the observations section, could have a tutorial. It’s not very intuitive; for example, I had to struggle a bit to navigate it.”

5.2. RQ2. What are the facilities and difficulties posed during the use of the instrument?

In relation to participants’ perceptions of the instrument and its effectiveness in identifying interaction design gaps or improvements considering feminist and inclusive values, three distinct categories were identified: **C03. Instrument Facilities**, **C04. Instrument Difficulties**, and **C05. Perceptions About the Process**. In the first category, participants expressed opinions regarding the perceived usefulness of the instrument throughout the

³<https://github.com/BabiDrummond/AssessmentofTechnologybasedonFeministInclusiveValues>

process, emphasizing elements that facilitated its utility the most. The second category outlines elements that hindered participants in using the instrument for evaluation. The last category depicts participants' reflections on the process itself, including challenges encountered and alternative approaches taken to complete the evaluation activities. Suggestions discussed by the participants included passages as below:

"I was unsure about the lack of evidence, whether it characterizes the item as 'No' or 'Not Applicable'. For example: Does the interface value collaboration among people, regardless of leadership level? There are no collaboration methods, but there are items about leadership. Now, in the item: Does the interface provide resources to help people who want to develop their leadership skills? There's a story about the data, but there's no information about developing leadership skills."

5.3. Discussions

The use of the instrument to assess technologies posed certain challenges in the evaluation process, particularly concerning **1. issues of instrument clarity and assigned activities**, as well as **2. usability problems that impeded the fluidity of the process**. Moreover, some deviations from the discussed values stemmed from elements that distracted participants. Consequently, participants tended to focus on these aspects rather than delving deeply into feminist HCI values.

However, the studies also demonstrated the instrument's utility in **1. highlighting areas for improvement in the design and/or quality of interaction in the examined technology**, while also **2. serving as a tool to expand vocabulary regarding the integration of feminist values in technology**. Through the evaluation process employing the instrument, participants demonstrated **3. increased empathy towards users affected by identified issues** and **4. engaged more profoundly in discussing ways to enhance interaction quality for women**.

As for the improvements to be made to the instrument, it is vital to highlight: **1. the need to ameliorate the organization and grouping of the items**, **2. the importance of providing clear and objective examples**, and lastly, **3. the necessity to create additional fields to allow evaluators to assess additional elements** they may consider relevant.

6. Contributions to the Web Social

The results of empirical studies revealed facilitation in identifying and extensively discussing issues related to feminist and inclusive values in web interfaces. Evaluators also identified design improvements aimed at incorporating gender-inclusive values into the interface. Within the context of Web Social, the proposed framework can serve as a meaningful tool for identifying interface issues that potentially impact female usage. This approach can assist designers and HCI researchers in adopting a more critical stance and in considering how to address feminist and inclusive values when building interfaces.

7. Conclusions

This work introduced the ATIV framework, designed for use by HCI specialists to evaluate web portals, focusing on female inclusivity. The construction process involved gathering contextual factors influencing women in technology, validating and standardizing

these factors, aligning them with feminist HCI values, and using them to construct the main instrument, where values served as constructs and factors as items.

The final instrument and framework were applied in empirical studies. The pilot study revealed necessary adjustments required to enhance engagement with the instrument's values. Subsequent studies produced more fruitful results, where participants not only comprehended and connected better with the proposed instrument, but also demonstrated increased empathy with the values, facilitated by the personas.

In general, the instrument provided more vocabulary to describe interaction issues regarding feminist and inclusive values. The studies also stimulated participants to engage in discussions concerning issues related to the language utilized, how the images were presented and what kind of information was available on the analyzed software. Evaluators also identified design improvements aimed at incorporating gender-inclusive values into the interface.

However, while effectively highlighting design issues concerning inclusive values, some participants reported challenges during its use. These challenges included unclear item definitions, confusion over subjective interpretations, and a lack of examples illustrating how to evaluate specific interface elements. Moreover, some participants encountered usability problems that diverted their focus, hindering their recognition of pertinent issues. Consequently, during discussions, they predominantly addressed these usability issues rather than focusing on the values themselves.

All the feedback offered by the participants were crucial for enhancing the entire process. Further research can illuminate which values and factors significantly influence perceptions of technologies and intentions to use them. Future studies can also delve deeper into assessing the clarity of the instrument with a larger number of specialists, and consider restructuring sections based on their feedback.

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