

# HCI Systems for Representative Democracy: Investigating their Universal Usability through Comparative Analysis

Mirza Salkic, Nimala Salkic and Lou Süßlin

Vienna University of Technology, Karlsplatz 13, 1040 Vienna, Austria

**Abstract.** This study investigates the intersection of Human-Computer Interaction and representative democracy, with the aim of bolstering citizen engagement in political decision-making. By assessing the usability, accessibility, and performance of Human Computer Interaction systems (HCISs), this study tries to offer insight on their capability to serve participation in representative democracies (RDs). With three HCISs chosen - PosterTalk, Wahlkabine.at, and Urban Grammar - user testing (n=13) unveils nuanced insights into their respective strengths and weaknesses. Notably, while certain systems exhibit commendable attributes, such as dynamic interfaces and inclusive design features, the absence of comprehensive quantitative data poses a significant challenge. This absence, including metrics like completion time, error rate, and task success, underlines a critical gap in understanding the true efficacy of HCISs in supporting RDs. Consequently, the study concludes that while HCISs show promise, further empirical investigation, particularly through robust quantitative analysis, is imperative for ensuring their effective alignment with the complex requirements of representative democracy.

**Keywords:** HCI · e-democracy · e-participation

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## 1 Introduction

Many people on this planet find themselves in some sort of representative democracy (RD) today: May that be federal parliamentary republics (e.g. Germany), parliamentary constitutional monarchies (e.g. the UK), semi-presidential republic model (e.g. France or Austria) or a presidential republic system (e.g. the USA) [6, 5]. As laws in RDs are passed, judged by and executed in top-down fashion, we wondered about how modern technology could be made use of to have citizens like themselves influence the decision-making process in these political systems. The large problem space is thus the overlap of Human Computer Interaction (HCI) and e-democracy [4]. Found literature in this problem space advised that more research is needed on how HCI systems (HCISs) can make it easier to participate and vote in representative-type political systems [7]. This work therefore compiles recent HCISs (2019+) that try to resolve this problem. Further, it purposes the meaning of making it "easier" to participate to be interpreted as HCISs adhering to the standards of the three well-established categories of Usability, Performance and Accessibility [cite]. Using 15 criteria over these categories, a benchmarking of three particular HCISs follows in form of user testing (n=13). Results show that the HCISs' scores for some criteria were good and for others not as much. For some of the criteria, the scores have also varied for the different HCISs, showing their insufficient fulfilment of the three categories. Our work therefore suggests that future HCISs should focus on delivering qualitative evidence on the extent they make participating and voting in RDs easier, e.g. by measurements in the mentioned categories or by considering the statistical effect of the system on users' perceived instrumentality of it to RD.

## 2 Related Work

Nelimarkka propoposed "more research is needed into systems that can better support today's representative-type political systems" and also that democracy may be improved by "making it easier to vote" [7]. The systems that would be up to usage would be of the interactive type, the hemisphere of HCI. The users of these systems would be any that would also participate in the processes of any entities in the RD of a given nation – users with very different needs and abilities (e.g. abled-bodiness) which need to be considered. This realization has also been turned into laws in various nation: In Austria, governmental websites and apps are required to be free of barriers to all users (Web Accessibility Act) and further, people with disabilities allowed equal participation in social life, both publicly (which is relevant to RD-serving systems) and commercially (Disability Equality Act) [11, 12]. Similar laws exist in other countries as well, i. a. in the USA (Americans with Disabilities Act, Title II) [13] and, to follow in 2025, Germany (Barrier-Free Act) [14]. Therefore, applications built to support RDs not only need to ensure high usability and a convenient User Experience, but also accessibility. This may be understood as *Universal Usability*, that according to Shneiderman, "[...] has emerged as an important issue and a topic for

computing research. The complexity emerges, in part, from high degree of interactivity that is necessary for information exploration, commercial applications, and creative activities. The Internet is compelling because of its support for interpersonal communications and decentralized initiatives: entrepreneurs can open businesses, journalists can start publications, and citizens can organize political movements" [10]. We suggest that systems fulfill the recommendations of Nelimarkka from a UI perspective, when the following is true of them: "*HCI systems, built to support or enhance representative democracy, fulfill their objective when they adhere to Universal Usability.*".

The second related work is by D. Dizdarevic who states: "Urbanization, the emergence of the sharing economy and the commercialization of public space present new challenges for society and makes new methods for public participation necessary." Furthermore, "In retrospect, this process was very powerful. It helped to support the large changes in the design and the concept and enabled a constant reorientation of the approach to solve the problem in question without losing focus." [8]

Another work derived from M. Oltay has following main problem statements, challenges within analogue, civil participation processes - the citizens being time dependent and them being location dependent to take part in those processes and lack of tools or tech knowledge. He also mentions that the online participation challenged by juridical obstacles has to be an equivalent to analogue participation through technical aids - tech pessimism. [9]

In order to answer our research question if they do genuinely support representative democracies and how, we have tried to find HCI systems which adhere to Universal Usability and have been tested quantitatively and qualitatively. The approach we are using is the comparative analysis by benchmarking through user testing of selected democratic HCI systems (n=13). In the user tests, participants rated a score the three systems by 15 concrete criteria over three categories (Usability, Accessibility, Performance).

### 3 Applied Methods

In this works' research, we have benchmarked three HCISs presented below, the selection of which was based on three criteria:

- Initial proposal at most 3 years before Nelimarkka's paper [7] in 2019 or more recent
- Addressing a problem anywhere in the decision-making process of RDs
- Being an interactive system

The benchmarking of these systems was accomplished through user testing (n=13). As proposed before, criteria of this benchmarking to assess the potential of these systems to support today's representative-type political systems was Universal Usability. This criteria we further broke down in three standardized features of quality of HCISs: Usability, Accessibility and Performance. In the

user study, participants gave scores to the HCISs ranging from 1 (lowest) to 5 (highest) for 15 criteria over these three features (see Table 1).

Category	Criteria
Usability	Intuitive design
	Navigation
	Feedback mechanism
	Accessible interactions
Performance	Speed
	Responsiveness
	Reliability
	Scalability
	Resource Usage
	User Experience (UX)
Accessibility	Screen Reader Compatibility
	Alternative Text for Images
	Keyboard Accessibility
	Color Contrast
	Not only Audio/Video

Table 1: Evaluation Criteria by Category

Two systems were then presented to participants as a functional prototype and one (PosterTalk) as a demonstration video showing the prototype used, as no functional prototype could be found or requested within the two weeks we were given for this project. The participants have been chosen amongst our colleagues and personal friends. All of the participants had normal vision, either by default or by using prescription glasses. For demographics, see Fig. 1.

Users Demographics		
Age / Generation	Generation X	2
	Millennials or Gen Y	10
	Gen Z or Centennials	1
	Woman	6
Gender	Man	5
	Prefer to self-describe	2
Education	High school graduate or eq.	0
	Bachelor's degree	5
	Graduate degree	8
Nationality	European	11
	USA	1
	Asia	1

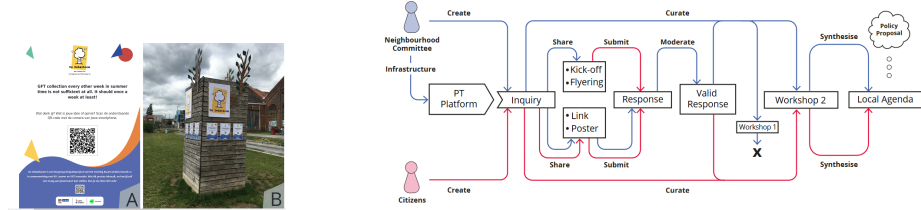
Fig. 1: Users demographics

The single criteria were explained in detail, and based on the users experience with similar topics and they higher level of education, it was possible to explain the terms clearly and in a short time. The applications have been tested at the TU Vienna and at the architectural office caramel architekinnen in Vienna.

We also explained to participants what single criteria mean in more specific terms. We then used the benchmarking results to compare the HCISs in how well they have performed overall and in each criteria and category to assess the potential of these systems to support today's representative-type political systems given the assumption previously stated.

## 4 Selected Systems

### 4.1 PosterTalk



(a) Digital poster and a printed one put up physically

(b) How citizens can influence the top-down decision-making process

Fig. 2: Overview of PosterTalk survey platforms

PosterTalk (2023) is a cloud-based survey platform with focus on privacy and inclusion, powered by paper posters that are physically put up on objects in public space [1]. These posters feature QR codes to be scanned (see. Fig. 2b) that lead to online surveys for public participation. Thus, PosterTalk is middle-out in design. The surveys serve the purpose of involving citizens in the top-down decision-making processes ("gatekeeping activities"), allowing for a degree of influence on the decisions from the bottom-up (see Fig. 2b).

### 4.2 Wahlkabine.at

Wahlkabine.at was a *Voting Advice Application* (VAA) for the Republic of Austria. In 2017, it has been redesigned as a result of a thorough study by Alexandra Geier on what makes a future-proof VAA [3]. The tool presents users with a series of questions, but one at a time (see Fig. 3a). Each of these can be answered with *Yes* ("Ja"), *No* ("Nein") or *Prefer Not To Say* ("Keine Angabe"); and then be weighed in relevance from 1 (least) to 9 (most). At the end the user is

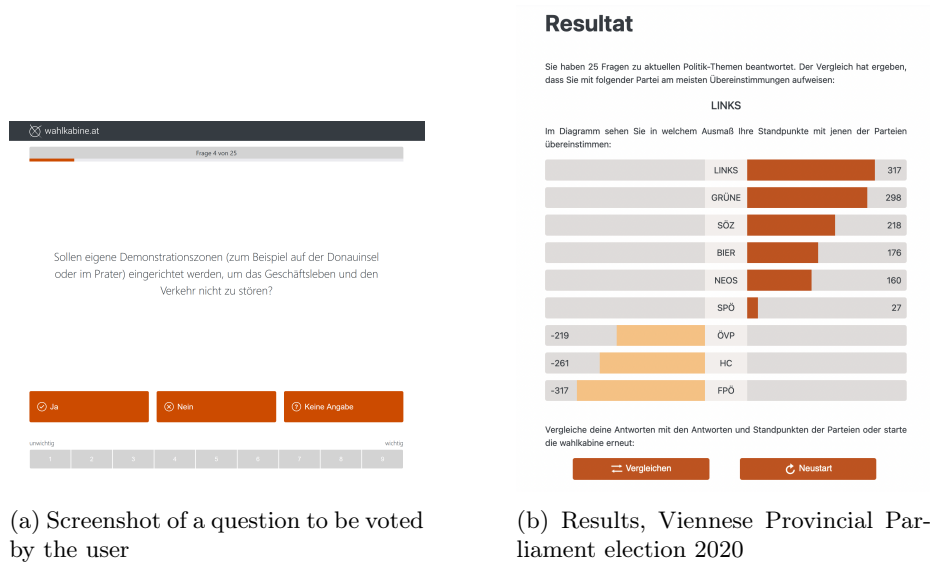
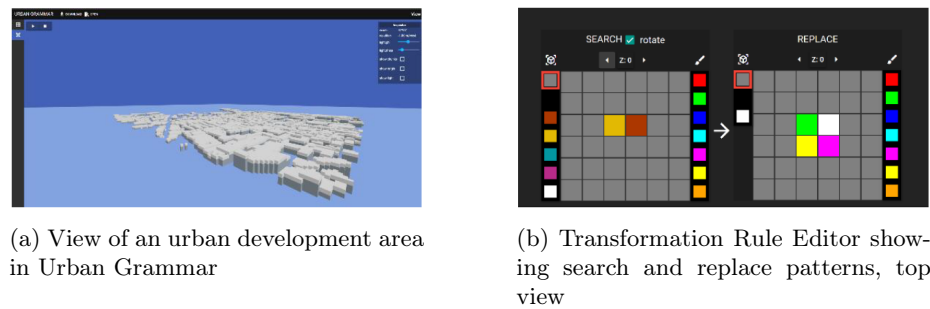


Fig. 3: Overview of Wahlkabine.at screens

presented with the best fitting parties according to the weighted answers for the given question catalog (see Fig. 3b).

### 4.3 Urban Grammar



Urban Grammar (2024) is web-based tool for urban transformation using cellular automata following the rules specified by the public [2]. It features a volumetric representation of a cityscape coupled to a "find and replace" editor which lets non-proficient users enter urban development scenarios. It makes predictions of urban development using the cell-based methods CA which consist of rules of the form  $\alpha$  to  $\beta$  that match a pattern  $\alpha$  in a square lattice and replace

it by pattern  $\beta$  to form the next state of the lattice. This approach aims at the democratization of urban development planning available to the general public.

## 5 Evaluation

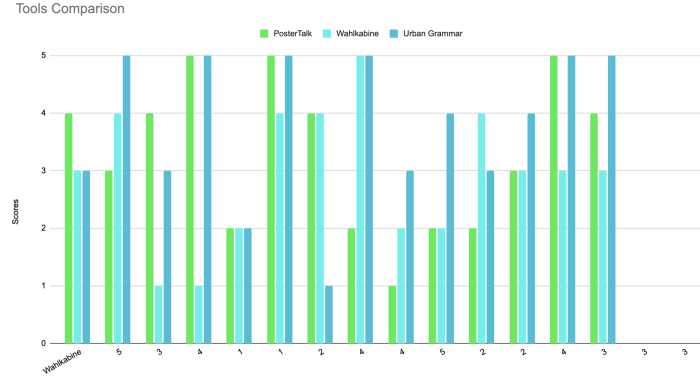


Fig. 5: Average scores (n=13) for HCI Systems evaluation over 15 criteria

As for accessibility, according to the results (Fig. 5), Wahlkabine has stood out with a lot of alternative text offered in HTML, which the others performed worse in; its color contrast performed poorly due to too bright text compared to the background. This was especially problematic when reading the question asked, the key objective of the system. In Screen Readers, only Urban Grammar scored well, as it has considered screen readers. The other tools seem not have to addressed this criterion in particular. All systems performed well in Keyboard Accessibility. Considering users rated Wahlkabine in criteria "Not only Audio/Video" with a 3 only, even though it always features text for its main components, testing participants seem to not have understood the question as intended. It seems they have instead rated it worse because they missed audio-support at times.

As for the performance, most systems, users could not understand what an app is really used for which has shown in the poor performance in UX across all systems. Wahlkabine performed worse than the other tools in speed as clicking through the single questions has been draining on users and slowed them down.

It is worth noting that in regards of perception of the systems, users have stated in the sessions that some were not that interesting to be used longer than five minutes (Wahlkabine).

We have also found that the creators of the systems considered in this work have not investigated usability, performance and accessibility through quantitative measuring in their initial papers [2, 3, 1]. In these, the authors have also not



looked at how their systems perform in terms of "perceived assistance to RDs" for users, which would be vital to underline if their objective is measurably fulfilled.

Our benchmarking via user testing has served as a first step to touch up on this lack of data and has shown that the selected three tools do fare well in some but not all of the criteria of Usability, Accessibility and Performance. This is particularly true of intuitive design, color contrast, feedback mechanisms, reliability and in providing more than just video and audio content. However, they also perform poorly in other criteria, such as UX, responsiveness and screen reader compatibility. Regarding to the feedback to responsiveness, user found it difficult for the two systems being suffering from crashes and freezes, and the third one (PosterTalk) lack of feedback by the creators.

## 6 Future Work

Judging from our results, we advise designers of HCISs to create dynamic interfaces that allow for an interactive experience that captivate users' attention. Future systems should definitely investigate accessibility as they need to support a broad range of users, given that very different people are able to participate in RDs. Further, the user testing conducted could be repeated in a more refined fashion. Due to short notice (2 weeks) we went with simple scoring over criteria. We advise this question to be investigated anew with standardized questionnaires (i.a. NASA-TLX, SUS) and clear question phrasing instead of keyword criteria. Such user studies could define clear tasks for these HCISs and measure completion time, error rate; and thus even learnability if tasks are repeated by the same user. We also advise to then record demographics of study participants, especially with regards to able-bodiedness, particularly vision. By doing so, replicability, objectivity and generalizability of the findings would be more credible. Generally, designers of HCISs should start investigating statistical effects on "perceived assistance" to democratic participation and on performance, usability, and accessibility.

## 7 Conclusion

We have found that most systems we considered hadn't lived for long. Wahlkabine was shut down in 2023, 5 years after the overhaul proposal through Alexandra Geier in 2017; though it had been started in 2002 for the General election in Austria. On May 17th 2024, Austrian journal *Der Standard* has reported it may be continued through funds [15]. PosterTalk also ended as an individual project as it was subsumed by the project CityStory.

The studies we have looked at in our problem space have not provided quantitative data, that is no time to complete, error rate, task success rate or navigation efficiency. As absence of evidence does not equal evidence of absence, we conclude that there is not enough quantitative data to be able to assert that HCISs would already support RDs properly. But there have been public participation

projects that were rated a success such as the revitalization of the famous shopping strolling promenade Mariahilferstraße in Vienna – in which the city council had residents contribute to *how* the revitalization would look like [9]. As this aligns with the top-down decision-making process common to RDs, this project might serve as inspiration on how to design HCISs for democratic participation. Perhaps then, providing evidence for its genuine helpfulness to coming to a decision (e. g. voting for a party) would be more attainable in future HCI research.

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## A Poster

