

MyPosition: Sparking Civic Discourse by a Public Interactive Poll Visualization

Nina Valkanova^{1,2}, Robert Walter¹, Andrew Vande Moere³, Jörg Müller^{4,1}

¹ Quality and Usability Lab
Telekom Innovation Laboratories, TU Berlin
firstname.lastname@tu-berlin.de

² Music Technology Group, Universitat Pompeu Fabra
nina.valkanova@upf.edu

³ Research x Design - Department of Architecture, Urbanism
and Planning, KU Leuven
andrew.vandemoere@asro.kuleuven.be

⁴ Alexander von Humboldt Institute for Internet and Society
Berlin

ABSTRACT

We present the design and evaluation of *MyPosition*, a public display in the form of a large projection, featuring an interactive poll visualization. *MyPosition* aims at facilitating the deliberation and comparison of individual opinions on locally relevant topics in an opportunistic and engaging way. We evaluated *MyPosition* in an in-the-wild study and demonstrated that the engaging nature of the installation was effective in enticing public discussion. We found that (i) the increased identifiability of users positively impacted the engagement with and the social debate around the installation, however lowered the actual polling rate; (ii) people submitted their personal opinion instead of playing around with the interactive features; and (iii) the display led to considerable discussion as well as nudging among people, in particular in zones beyond the interaction area in front of the screen.

Author Keywords

Public display; urban screen; urban visualization; in-the-wild study; awareness, reflection; gestural interaction.

ACM Classification Keywords

H5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous.

General Terms

Design.

INTRODUCTION

Interactive electronic displays are becoming increasingly ubiquitous in public space, showing up in bus stops, community centers, or museums. As situated media technology is rapidly maturing, it is likely that the trend will accelerate, so that people will become more accustomed to it [14, 32]. Although the majority of currently existing urban displays serve mainly commercial, artistic or entertainment purposes, they might offer a promising communication platform for citizens [5, 9, 34],

such as for increasing public discussion on socially and locally relevant topics [1, 31].

The identification and recognition of local concerns and views forms an essential aspect of encouraging civic engagement, allowing the deliberation of public opinion and the discussion of alternative perspectives [35]. Several initiatives have already addressed the idea of creating new, agile platforms of communication by embracing the potential of online technology [26]. For instance, it has been shown that community networks [32] are able to support local engagement and collaboration on civic topics [24, 29]. However, these platforms are often not easily accessible (i.e. people need to remember ways of accessing these tools, provided they have ways to access the Internet) or opportunistic (i.e. people need to dedicate time and effort). Furthermore, they tend not to be well situated, as they present a ‘local’ concern in a medium that is unrelated to the underlying social-cultural context [37]. Besides, these tools have limited ways of synchronous situated social interactivity, such as face-to-face encounters and discussion.

We propose to address issues of polling of local opinions by combining the opportunistic and situated accessibility of interactive public displays with the qualities of a *social visualization*. By its original definition, social visualization describes the enriching of social (electronic) communication by making its salient qualities visible in easily accessible and understandable ways [8]. Research in this field has indicated that people seem to become encouraged to use social visualization for participative purposes, and potentially organize social activities alongside [7, 12]. While social visualization has mainly focused on graphical depictions of online and social media activities, little is known on whether it can be successfully deployed in other contexts or presentation media.

For instance, there are early indications that the public visualization of private data may incite physically situated discussions and debate by viewers, as the public externalization of private data can trigger feelings of friendly competition, social comparison, or social pressure [36]. Inspired by previous findings on situated polling for increased opinion deliberation on a given local topic [35],

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we thus focus on enticing situated discussions and reflections by way of moving online-style, non-scientific polls to the public realm, and explicitly visualizing the resulting statistics.

We contribute by (1) introducing the design of an interactive polling visualization of opinions originating from passers-by, and based on gesture-based interaction; (2) proposing different degrees of identifiability of the visualized opinions; (3) evaluating *MyPosition* in-the-wild; and (4) discussing the implications for design and use of public interactive visualizations as tools for increasing civic discourse. Our study demonstrated that the engaging nature of the installation was effective in enticing public deliberation and discussion. The main findings that emerged from the study are: (i) increased identifiability of the visualized opinions increased the motivation to engage with the installation and forged open social discussion, however less people actually submitted an opinion; (ii) visitors expressed and submitted their personal opinion instead of playing around with the interactive features of the installation; (iii) the display led to significant discussion as well as nudging, in particular outside the interaction area.

RELATED WORK

Several in-the-wild studies of public displays have been presented, ranging from museums [17] to urban settings [23]. Such public displays are generally designed to communicate information of relevance to a specific group of people [13], support opportunistic conversations [19], provide playful information experience [17], or enrich casual interactions of people sharing a physical environment [21]. Few public displays have been specifically designed for a civic purpose, such as to increase awareness, discussion and reflection on local topics. We compare *MyPosition* to existing work regarding SMS-based civic communication displays, playful interfaces for civic discussion, and public voting systems.

SMS-based Civic Communication Displays

Some public displays create an open forum for public expression by providing a communication channel to citizens via SMS messaging, for instance *TexTales* [1] or *Discussions in Space* [31]. *TexTales* presents civic topics, such as “smoking in public places”, whereas *Discussions in Space* is specifically focused on enticing civic interaction within the context of urban planning proposals. Results from these projects indicated that conversations might be sustained not only within the system, but also carried on in the physical and social space around it. We were inspired by this observation and aim to provide a more detailed analysis of the actual in-situ engagement of individuals and groups with the installation and its underlying topic. We also explore more immediate and playful interaction based on computer vision, thereby avoiding the moderation requirement of the SMS input modality and the associated feedback delay.

Playful Interfaces for Civic Engagement

Some digital urban installations aim to encourage more playful or reflective civic engagement on socially relevant topics, exploring the experiential and reflective potential of

the interactive system [2]. For instance, *CO₂nfession* constitutes of a video-booth-like installation, where citizens are invited to enter and ‘confess their sins’ related to their CO₂ usage, which are then broadcasted on urban displays distributed across the city [20]. The system capitalized on the increased potential for reflexivity with regards to personal and civic values. In *MyPosition*, we explore a more in-situ communication between citizens, hoping to encourage active engagement with others’ opinions and stimulate public discussion. Similar to *MyPosition*, *Climate on the Wall* was conceptualized to encourage passers-by to communicate their opinion on climate change, by forming statements with their bodily movements along a projection wall [11]. A field trial showed that the playful nature of interaction was actually a hindrance for the participation, as many participants rather played with the interaction and few meaningful sentences were formed [11]. With *MyPosition*, we aimed at finding a good balance between playful interaction and meaningful participation.

Public Voting Systems

Several research projects already used voting mechanisms in a social context such as bars [25] and classrooms [3] in order to encourage public opinion deliberation. *MyPosition* extends this work towards a more civic focus and a systematic in-the-wild evaluation with a larger group of people. Recently, Taylor et al. [35] presented results of a long-term deployment of a voting device within three highly frequented public locations, allowing residents to express in-situ a *yes/no* opinion on a locally relevant topic [35]. *Viewpoint* aimed to increase community members’ individual perception of their own efficacy. *MyPosition* builds on this work, while trying to promote awareness and on-site social debate among participants. *MyPosition* is also designed for rapid, opportunistic responses, yet allows for a wider range of sentiments to be submitted. Furthermore, *MyPosition* is a social visualization, in that individual opinions are still readily recognizable and identifiable, utilizing more playful and engaging interaction.

DESIGN PROCESS

MyPosition was developed through an iterative design process involving the production of successive designs, the evaluation of low-fidelity sketches, mockups, working prototypes, and preliminary in-the-wild tests.

Design Goals

We set out to develop an urban polling visualization that would entail several design goals: a) provide awareness on individual opinions submitted by passer-by; b) motivate participation through engaging and playful design; c) provide a low-barrier entry for participation while minimizing misuse or accidental submissions of opinions; d) explore anonymity in participation by exploring different degrees of identifiability of the individual contributions; and e) encourage opportunistic and spontaneous conversations.

THE PUBLIC POLL VISUALIZATION “MYPOSITION”

We used the Design Space Explorer Framework for Media Façades [6] to structure its design goals in regards to its

location and situation, form and material, participation and visualization design.

Location and Situation

A public situation determines the shared understanding and social interpretation of cues present in the physical environment [16]. Therefore, we specifically aimed at locating *MyPosition* within an environmental context that naturally hosts informal, opportunistic social activities and encourages different forms of informal gathering, dwelling and transition (*design goal e*), such as spaces in front of local cafés or shops, or entrance halls of cultural or community centers.

Physical Form and Material

MyPosition was implemented using a large rear projection canvas measuring 5x2 meters, two short-throw projectors and two Kinect cameras. All technical devices can be placed behind the screen to provide a compact setup that could be seamlessly and securely integrated in the physical environment. The interaction zone, i.e. the floor area in front of the screen in which users can be detected, measures about 5x3 meters.

Participation

MyPosition allows any passer-by to express her opinion on a given topic (*design goal a*) by way of a full-body interaction method. We specifically chose this type of interacting in order to: i) create a more enjoyable experience when participating (*design goal b*) in an otherwise relatively serious context [11], ii) support a more lightweight, inadvertent way of interaction [23] (*design goal c*), and iii) allow multiple participants to simultaneously interact with our system (*design goal c*).

A person is able to express her opinion by consciously positioning herself along the display in front of a desired opinion section along a 4-point scale: ‘strongly agree’-‘agree’-‘disagree’-‘strongly disagree’. In order to submit her opinion, the participant has to raise her hand. This gesture was preferred as it is commonly used to visibly express opinions in public spaces such as town halls, podium discussions, or classrooms. To avoid accidental submissions, we introduced a dwell-time, for which the gesture has to be performed. By ‘forcing’ the potential voter to perform an explicit gesture, this ‘submission’ mechanism also aims to minimize possible misuse such as flippant [35] or merely playful interaction [11]. (*e.g. design goal c*) This act of public ‘submitting a personal opinion’ was also meant to enhance public engagement by providing an opportunistic moment at which other passes-by could observe and discuss the action taking place (*design goal e*).

Visualization Design

We chose a visualization style that combined the “seriousness” of the topic with a more accessible and enjoyable way of representing the opinion statistics. The visualization consists of a set of square tiles, of which each corresponds to an individual opinion submitted by a passer-by (Fig. 1.D). Each of the preference options is represented by a different color and a textual label, and occupies an equally large horizontal section of the screen (Fig. 1.B). The polling topic is shown on the top (Fig. 1.A).

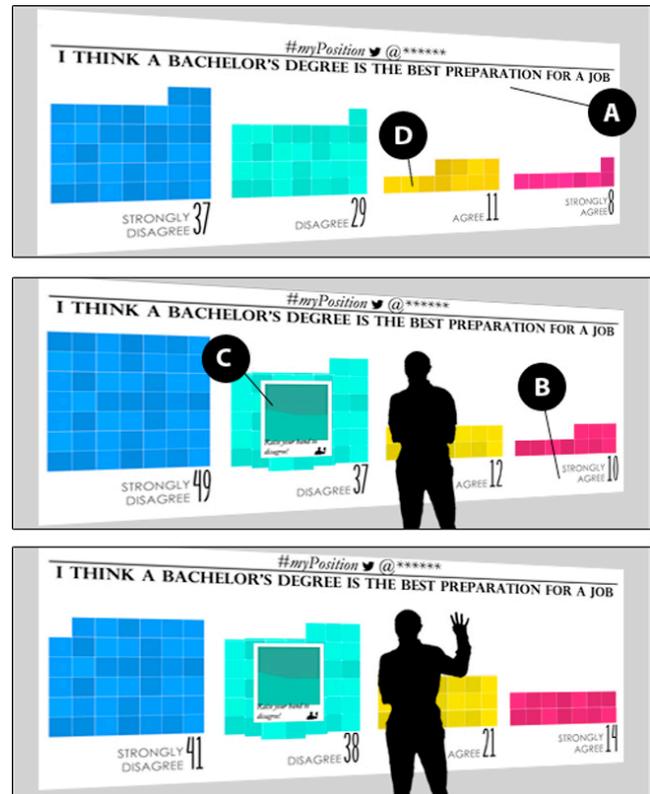


Figure 1: *MyPosition*: the poll visualization (top), a participant positioning herself (middle) and submitting opinion (bottom): (A) The polling topic; (B) One of the four polling options; (C) A preview of a currently interacting participant (see Fig. 2 for details); (D) A tile corresponding to a submitted opinion.

Animations

We implemented several dynamic visual features, to make the visualization richer, vivid, and more understandable. For instance, tiles that are in the direct proximity of a visitor who is passing through the interaction zone enlarge in a smoothly animated way to attract her attention. Once this person moves closer to the projection, her relative position – and thus her implied opinion (see subsection *Participation*) – becomes previewed as an animated ‘polaroid’-like visual form, rendered over the existing visualization (Fig. 1.C and Fig. 2). An animated textual hint explains how to place a submission: “Raise your hand to agree!” (Fig. 2.A), as an efficient, integrated visual ‘hint’ to inform users on how to perform a gesture in a public display setting [38] (*design goal c*). Once a participant starts to correctly perform the polling gesture, a clock-wise animation gradually colors her preview, thus providing real-time progress feedback on the dwell-time (Fig. 2.B). Upon registering a submission, the screen shortly flashes to visually acknowledge the submission. The newly created tile then gets added to the collection of tiles that were already submitted.

Representation of Opinions

In order to explore the relationship between (pseudo-) anonymity and participating in the polling (*design goal d*), we created three different representations of an individual

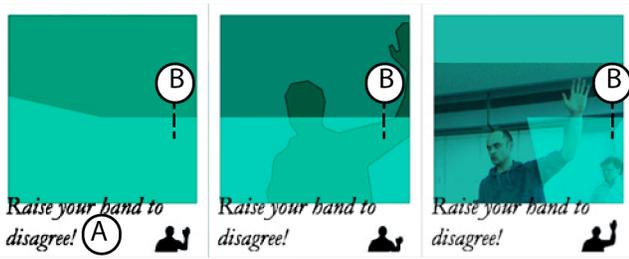


Figure 2: Close-up of the preview of a currently interacting participant in the three representation modes (color, contour, image); (A) The integrated hint for performing the gesture; (B) the clock-wise visualization of the gesture dwell-time.

opinion, each representing a different degree of identifiability: *color*, *contour*, and *image*.

- In *color* mode (low identifiability) all tiles look identical, making it impossible to identify which opinion was submitted by whom (see Fig. 1-Top).
- In *contour* mode each tile contain a graphical contour of the person who placed the opinion, as captured by the camera. While it is difficult to identify other participants, a participant might be able to recognize her own submission (see Fig. 1-Middle).
- In *image* mode (high identifiability) each tile contains a photo of the corresponding participant, making it possible to identify who submitted what preference in the visualization (Fig. 1-Bottom).

PRELIMINARY FEEDBACK

In order to identify potential usability flaws, we evaluated *MyPosition* in an expert study consisting of three HCI researchers. The two most significant results included extending the dwell-time of the polling gesture (2s) and adding an explicit representation of the dwell-time progress (Fig. 2.B). We also collected informal feedback from five non-experts, in particular on the social aspects of the polling gesture. We did not discover any concerns about performing it in a public setting.

PILOT FIELD STUDY

MyPosition was installed for five consecutive days in the district of [Anonymized], where it was accessible to passers-by and visitors via a large rear projection on the glass pane of a window of a local cultural event center (Fig. 3). We took notes on people's behavior towards the installation (e.g. attention and reactions) for 3 to 4 hours every afternoon (from 4pm to 10pm). Additionally we conducted interviews with random participants during an international freelance event hosted in a semi-public indoor lounge of the same center. After discussion with the organizers, we chose "*I think that freelancing is a good way to make a living*" as the first polling topic. The interview questions dealt with the general attitude towards the installation and the submission and visualization of votes in a public setting. In total, we talked to 6 people (4 male, 35-50 years), all self-employed professionals.

Findings

While approximately 70% of all outdoor passers-by were attracted by the inadvertent visual feedback produced by their movements, only few stopped and had a closer look. The unpleasant weather conditions (i.e. below-freezing temperature and snowy conditions) hampered the overall motivation to stay, as well as the establishment of idling, exploration and discussion zones in the vicinity of the installation. In contrast, the indoor placement of *MyPosition* did not facilitate any inadvertent interactions, as events took place in an area spatially detached from the installation's vicinity, so people's paths upon entering the space did not pass by. However, the setting and in particularly the social laid-back nature of the event provided situations of idling and contemplation around *MyPosition* after the end of the event. Participants who approached, considered the installation generally quite understandable and appealing. Interviewees suggested various possible venues and application areas for further integration, such as for education, general referenda, or local community issues. Several participants criticized the visualized topic as being too general for the people at the setting to engage. While people seemed comfortable with the public way of polling, we noted several concerns about the public collection and possible uncontrolled publication of private opinions, with several participants mentioning Facebook or other online platforms characterized by exposed social data.

FIELD STUDY

We deployed *MyPosition* over the course of one working week in the foyer of a large university cafeteria. As a topic, we chose "*I think a bachelor's degree is the best preparation for a job*". This choice was motivated by a recent and highly debatable change in the university degree system in [Anonymized]. The goal of the study was to gain insight into the following questions:

- What is the impact of identifiability on polling behavior and participation?
- Does playfulness of the display, including its public gesturing, interfere with meaningful participation?
- What are the social interactions caused by the display?

Location Description

The deployment location was mainly visited around noon by students or staff of the [Anonymized] and [Anonymized], as well as locals living nearby. The contextual setting of the space was characterized by several distinct zones: two *transit areas* situated between the main entries/exits and the dining-hall of the cafeteria; a *waiting area* in front of a coffee shop, as well as several *sitting areas* (Fig. 7). Based on previous research [20] and our experience from the pilot studies, we situated the projection in a transit area in front of the large sitting area, to maximize potential overlapping situations for both incidental interactions with the installation as well as idling, contemplation and gathering in a more broader space (Fig. 7).

Observations

Two researchers observed passers-by for 4 to 6 hours throughout the evaluation period. We kept field notes such

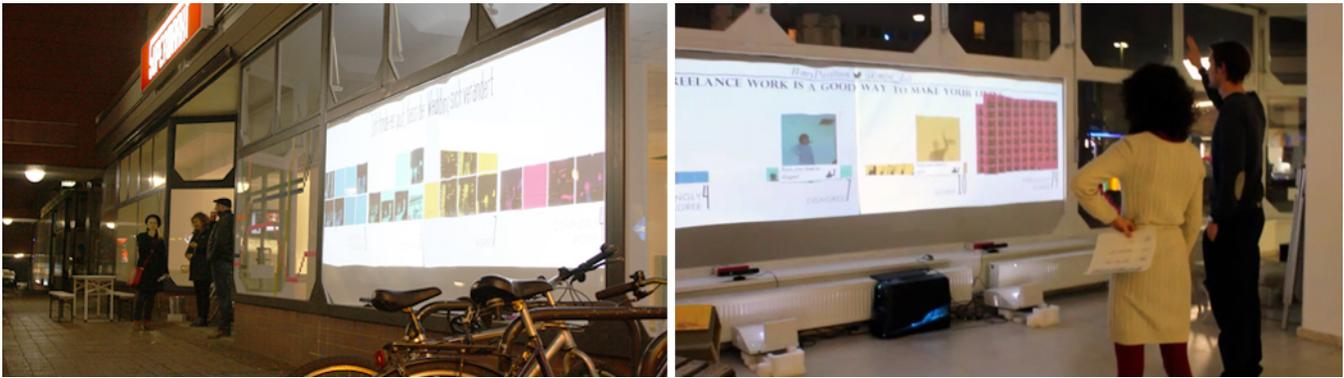


Figure 3: Pilot field study: outdoor (left) and indoor (right) settings. A participant (right) is placing an opinion by raising his hand.

as simple sketches annotating the relative locations and movements of passers-by. We observed and listened in to visitors, capturing their initial behaviors (e.g. direction of movement, attention, and reaction) as well as their opinions during their interactions or while discussing among themselves. To facilitate the process, we devised observational categories that were subsequently refined. In an overall period of 5 days (approx. 30 observation hours), we took notes of about 445 random persons who noticed the projection, 356 of which (80%) were in groups.

Semi-structured Interviews

We approached individuals and groups of people who had interacted with *MyPosition* and/or spent at least 2 minutes in front of it. The interviews lasted from 5 to 20 minutes and were typically performed after visitors submitted their opinion(s). At the beginning of each interview, we inquired about the purpose and habits of visiting the location and their initial motivation for approaching the projection. We further asked about general polling habits, civic discussion behavior, and attitudes towards engaging in issues related to the location. We also noted age and gender of participants, and their social context (e.g. whether they came alone, in group, etc.). The interviews included questions regarding *MyPosition* in terms of its understandability, its potential usefulness, its interactivity, the representation of opinions, as well as any other suggestion or thought in relation to the project. Overall, we conducted 17 interviews with 26 visitors (3 female). We attribute the unbalanced gender to the higher ratio of male students at the nearby technical university. We interviewed 9 individuals, 7 couples and one group of 3 people. The majority of interviewees were between 20 to 30 years old (except of 5 who were between 55 and 65 years).

System Logs and Captures

Our system continuously recorded anonymous data of passers-by and participants, such as log files, screen video captures and depth image streams. Besides the three-dimensional position data of each individual that entered the interaction zone (captured at 30 Hz), the log files contained timestamps of all relevant user events, such as: visitors entering or leaving the interaction zone; positioning themselves in front of a specific opinion; or performing the polling gesture. The screen content was captured in full resolution at 15 frames per second (fps), while the depth

image streams of the sensors was captured at 30 fps. Over the course of the deployment, we collected data of about 4980 passers-by. As 80% of passers-by occurred within the core hours (12pm-3pm), our quantitative analysis is based on that time period.

Experiment

To quantitatively assess how the different opinion representation modes affected participation, the system automatically switched between *contour*, *image*, and *color* every 30 minutes (see Figure 1). Only opinions that were placed during the current mode were presented on the screen. In order to minimize any effect of the order of options on polling, after half of the deployment time we reversed the order of the options.

Data Analysis

We analyzed our collection of field notes and visitor opinions using grounded theory to draw bottom-up findings based on the direct quotations and to establish hierarchies and connections among remarkable findings. Apart of the the descriptive statistics of visitors' participation, we used the system logs together with the interview data to evaluate the impact of identifiability. We further used this data to triangulate participants' comments and reactions upon participation.

RESULTS

Self-Reported Perception of Community Engagement

Our quantitative data analysis is based on an average of 880 (min=760, max=960, std=75) daily passers-by between 12pm-3pm. People stayed in front of the projection on average for 4.6s (std=16.1s). Those, who submitted an opinion stayed for 27.9s (std=41.9s) and those who did not for 3.9s (std=14.2s).

All interviewees turned out to be regular (daily- or weekly-basis) visitors of the university restaurant. The majority of them (77%, 21/26) were students or alumni of the university (aged 20-35 years), the rest were adults of varying backgrounds and professions ranging from 45 to 65 years, living close by. While 62% (16/26) claimed to usually participate in municipal or state elections, the majority (69%) reported to usually not engage in community or university issues. Some of them explicitly stated the reasons, which ranged from a lack of time, to the fact that they could no longer participate as they were no

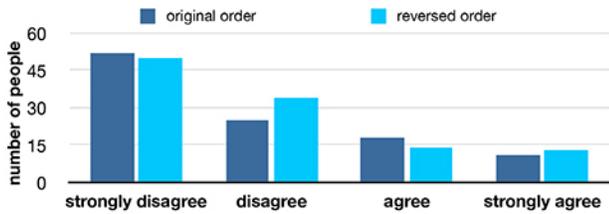


Figure 4: The change of order of the visualized options did not change the distribution of visitors' opinions.

longer university students. In summary, the engagement reported by visitors at the deployment location was relatively low.

Impact of Identifiability

Did People Submit an Opinion?

From the log files, we extracted the conversion rates (opinion submissions per passers-by), which we considered as a measure for the willingness of visitors to submit an opinion to the system. Out of the 880 passers-by, recorded in the core hours, 217 submitted an opinion, with a conversion rate of about 5%. We observed the lowest conversion for *image* (3.9%), and higher conversions for *contour* (5.7%) and *color* (6.1%). While we could not detect significant differences between *contour* and *color*, significantly less people submitted an opinion in the *image* mode compared to *color* ($\chi^2=6.5$, $p<0.02$) and *contour* ($\chi^2=4.6$, $p<0.04$). These results thus indicate that people are more reluctant to participate directly if their opinion is more recognizable.

How Did People Perceive Their Increased Identifiability?

Interestingly, when asked whether they have any concerns with the opinion representation, 79% (11/14) of the interviewees in *image* mode claimed it did not bother them at all, e.g. “[...] It does not bother me, I think it is good like that, more interesting and evocative for the people.” (P10), or “No, totally fine with me, people should see what I think!” (P21). Some even stated that their participation already implied their firm position: “Of course not, if it bothers me, I would simply not participate in the first place!” (P3). Others explained that the image representation did not affect their privacy: “Definitely I think image is a good option, actually it is relatively anonymous.” (P13).

On the contrary, around 78% (7/9) of the interviewees in the *contour* mode were rather skeptical towards a more recognizable opinion representation in case of a “more critical” context, with a majority (67%) referring to polling domains with traditionally higher demand of security, e.g. “If it’s about elections of the parliament, I would rather stay more anonymous.” (P8), or “Hmm, if it’s something serious I would find it difficult to see my image displayed. It depends on the question.” (P5).

How Did People Perceive Others’ Identifiability?

Our interviewees expressed differing views regarding their opinion about being able to see the opinions of others. The majority of them (62%, 16/26) found that this visualization sparks curiosity in so far they felt incentivized to

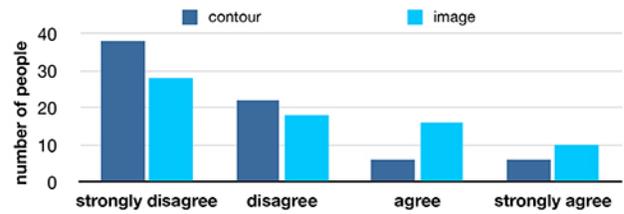


Figure 5: Visitors’ opinions were more evenly distributed in the image mode, Significantly more people chose ‘in favor’ in the image mode ($\chi^2=7.0$, $p<0.01$).

participate, e.g. “Seeing others’ votes makes it more interesting for you to participate.” (P7). In particular, some seemed to find the ‘personalized’ character of the visualization appealing. For instance, P3 (*image* mode) explained: “[...] It’s extremely cool to see the pictures of all others. It is not just an impersonal color chart as we know from newspapers,” or (P10 – saw all modes): “The contour is playful, it shows movement and personality, it motivates people”. However, several participants expressed their doubts about the bias of one’s opinion when all others are visible, e.g. “[...] Surely the fact that you see others influences somehow.” (P5).

How Did People Opinionated?

Our log files revealed that 47% of the people chose ‘strongly disagree’, 27% for ‘disagree’, 14% for ‘agree’ and 12% for ‘strongly agree’ (out of a total of 217). Reversing the order of the four visualized options did not influence the distribution of the submitted opinions (Fig. 4). This indicates that the vast majority of people intentionally chose ‘against’, regardless of the order.

Further, we extracted the distributions of participant opinions across the options from across the three representation modes. Interestingly, significantly more users during the *image* mode were ‘in favor’ of the statement (“agree” or “strongly disagree”) compared to the *contour* mode ($\chi^2=7.0$, $p<0.01$). In addition, in the *image* mode, the submissions across options appeared to be more evenly distributed than in the *contour* mode (see Fig. 5).

Playful vs Meaningful Submission of Opinions

Did People Submit for Their Personal Opinion?

Overall, people’s polling behavior represented their actual opinion, rather than merely trying out the interactive features of the system, an issue originally reported in [11] and [33]. Most of the interviewed visitors (81%, 21/26) had placed an opinion immediately before the interview: 91% of them were ‘against’, and 9% ‘in favor’ of the topic (similar to the logged general polling results). When asking them directly about their opinion, these participants confirmed the preference position we had noted beforehand. Seven of them even went on and specifically showed us their submissions in the visualization, e.g. “Look, that is my vote, I definitely disagree” (P6). We observed only one case, where two guys were making funny poses while interacting and one of them accidentally chose ‘agree’. However, shortly afterwards he complained, “Oh, damn it, now I voted here, and it stays!”. He then noticed a man nearby the



Figure 6: In-the-wild deployment at a university cafeteria lounge. A man positioning himself along the visualized options and a group of friends discussing his participation.

installation, assuming that he was related it and asked him "Could I delete my vote, or move it to 'strongly disagree'?".

Public Character of Polling

The act of positioning oneself along the projection in order to choose the preferred option together with the explicit polling gesture imposed a publicly recognizable aspect to participating, which evoked curiosity and taught other passers-by how to participate. All interviewees who had placed an opinion (81%, 21/26) perceived the gesture-based polling as "entertaining", "cool", "much funnier [as traditional polling mechanisms]" and "easy to use." Although some visitors perceived the polling gesture as intriguing, others thought it was quite 'exposed'. Interviewee P23 (*image mode*) was even more specific: "People see me all the time, if everybody is against, I would think twice about what to vote for." One interviewee claimed this was due to the 'openness' of the spatial layout around the screen: "[...] Of course, the fact that you can be seen ... creates a sort of stage. [...] If it were in sort of a corridor, that people won't feel that observed." (P9). Others related this 'exposure' to the time it took to place an opinion: "[the visibility] is not a problem for me because it's only for a short time and does not stay" (P10), and "[...]. If [polling] were quicker, it would be more anonymous." (P6).

Spatial and Social Interaction Patterns

We observed that *MyPosition* also created several zones of engagement within a larger area of the deployment (see Fig. 7). Outside of the active interaction zone, passers-by engaged with *MyPosition* in several other zones, such as the sitting and waiting areas in the vicinity of the projection. We also noticed that visitors congregated outside of the camera field of view, such as around the two columns located on both sides of the sitting area. These observed zones relate to the "comfort spaces" discussed in [10], which tend to give "physical and psychological comfort [...] by providing a line of sight, but giving people the feeling of being 'out of the way'". However, we observed that this engagement often became more active than passive contemplation, such as reading aloud, or debating and commenting in group.

Social Learning and Social Teaching

We noted that visitors tried out the interactive features or attempted to submit an opinion, as a consequence of observing others interacting, similar to the *social learning* effects perceived in other public screens [27, 38]. We noticed this behavior in approximately 8% of the observed cases (35/445), which mostly unfolded around some of the comfort zones and the zone in front of the projection (see Fig. 7. A).

A more frequently observed social configuration (approximately 31% of the observed group cases, 110/356) was 'social teaching', where one person teaches the other (s) about the features of the installation. This situation occurred mostly among couples or groups of acquainted people. In fewer instances, mostly around the comfort zones, we observed 'passive' social teaching, where people explained specific features to their companions. While previous work has reported 'teacher-apprentice' social configurations along an interactive multi-touch wall [27], we observed social teaching happening in a larger number of engagement zones (see Fig. 7.B), often leading to participative behaviors.

Social Discussion

The most spatially fragmented yet most frequently observed social behavior (approximately 52% of the observed group cases, 185/356) consisted of deeper discussions about *MyPosition*. The majority of discussions occurred in the waiting area in front of the coffee shop (Fig. 7. C), as well as other spots within the upper transit area, where passers-by had the most optimal overview of the installation. People engaged less frequently in debate in the interaction zone in front of the projection itself, in the comfort zones, and in lower transit area close to the exit. Discussion topics included: a) the visualized polling topic and their personal preferences; b) the visualized patterns and polling results; and c) data privacy issues.

a) *Polling Topic*. Often discussions about the topic were triggered by more 'implicit' interactions by one or more members of a group. Visitors would pass through the space, notice the screen and stop for a bit observing it. They would ask each other "What do you say?" and receive response such as, "Well, obviously not [agreeing]!". They would frequently start debating university degrees or graduations afterwards.

b) *Visualization and Results*. Over time, passers-by seemed to 'follow' the development of the visualization, as we noted several instances of people observing that "something has changed" [i.e. the opinion representation mode, or the order of options], and discussing the possible causes of these changes, such as "privacy reasons", or to "make it statistically correct". The collective visualization of all submitted opinions (see Fig. 1) seemed to encourage discussion about the result distribution, e.g. "Look, only five say that they totally agree," or "There is a big contrast between the votes".

c) *Data Privacy Issues*. Similar to our observations from the pilot field study, the *image* representation mode often prompted debates about the perceived privacy of submitted

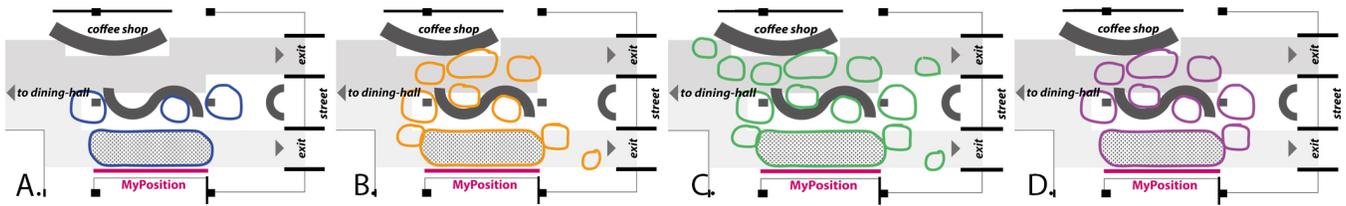


Figure 7: The engagement areas created by MyPosition (denoted by blobs): A. Learning; B. Teaching; C. Discussion; D. Nudging. These participative behaviors were observed in a much larger area than the interaction zone in front of MyPosition (dotted area).

opinions. For instance, a girl left her group of friends, standing in the upper transit zone, to submit an opinion. Upon her coming back to the group, one of her companions said jokingly: "Now they know everything about you!". Often privacy concerns also related to potential future publications of the data. One girl, participated with her back to the projection, explaining to her friend: "I don't want to be seen on Facebook!". We are aware such privacy issues would be more outspoken and hazardous if opinion questions are more provocative, contested or politically sensitive.

Social Nudging and Critique

Visitors often explicitly prompted their companions to submit an opinion or criticized the intentions and opinions of others. These social behaviors were noted in approximately 16% of the observed group cases (57/356). The majority of the people who nudged other visitors had already participated. These actions were often accompanied by humorous or ironic encouragements. For example, we observed two friends passing-by, one of them knew the installation already. He drew attention to MyPosition, by prompting him: "Look over there, that's something for you! You are so democratic, right; you always like to go voting...". Moreover, the public visibility of submitting an opinion triggered open critical attitudes towards others, which often occurred within the social context of groups. A young male prompted his friend to participate. Upon his friend saying: "I strongly agree.", the first man responds, seemingly surprised: "Are you serious!? You agree on this?". The second one did not submit an opinion. Critical attitudes were also openly expressed towards non-present participants' preferences, reflected in the visualization: "Look over there! Somebody has agreed!"

DISCUSSION

Whereas the most valuable effect of MyPosition consisted of its ability to cause cooperative discussion, reflection and contemplation of a civic issue in a public setting, several issues should be considered when designing an interactive poll visualization placed in a physical environment.

The Identifiable Self

The identifiability of the person and her opinion in the *image* mode did not seem to cause concerns among interviewees. However, the biggest impact was observed in the polling conversion rate dropping by 36%, which means that some people simply did not submit an opinion in this representation mode. Furthermore, opinions were more evenly distributed and significantly more positive for the *image* mode, compared to the *contour* mode.

Design Implications: There may be concerns related to individual data privacy, or social factors which influence these different behaviors, especially in settings aimed at the general public, rather than a small co-located group such as in [17, 14]. Some of those people who were against the visualized statement, would not participate due to the higher identifiability of their opinion in the *image* mode. Conversely, the situation of expressing opinion on an issue, implicitly related to the institution hosting the display (in this bachelor degree/university), would lead to a more conformist behavior, when it comes to an open criticism. Future studies could explore how the explicit choice of identifiability may influence one's participation behavior.

The Identifiable Others

Generally, people seemed to consider the identifiability of opinions on the screen stronger than the immediate publicness of the polling itself, as illustrated in the case of the girl submitting her opinion with the face away from the screen (and towards the audience). In contrast, the ability to identify *others* was described as more "intriguing" and showing more "personality". While we did not observe any particular attitudinal differences across the different representation modes, the public and collective depiction of people's opinions sparked considerable discussions. People compared and contrasted the visualized results, and often loudly reflected, especially in cases of those opinions, which were in line with the represented majority. Conversely, people would publicly criticize the opinion 'outliers' - e.g. the ones who have submitted a positive opinion towards a statement, which is predominantly disagreed with - both the ones already depicted the visualization, as well as potential participants in the social space, they were part of.

Design Implications: This calls for attention towards the social challenges involved with the visibility of individual participation contributions in public visualization settings: how would people's own opinion be effectively influenced when others' opinions are readily visible, is still an open question. Furthermore, while the open critical debate is a desired result, those who are less inclined to publicly submitting personal their opinions, might be even inhibited to express their views, when social pressure towards the 'correct' contribution is induced.

Naturally, our findings regarding identifiability and privacy are limited to more innocent or playful polling questions, and should not be extrapolated to more sensitive, contested or controversial kind of polls.

Playfulness vs. Meaningful Discussion

Previous research has pointed out that designing urban interactive platforms, which can both communicate meaningful information and engage, is a challenge [11]. Our field study demonstrated that *MyPosition* has achieved a relatively good balance between engaging and playful design and enticing meaningful discussion regarding the topic at hand. Compared to other public interventions (e.g., [29] and [33]), we opted for a playful, bodily interaction in order to increase the engaging capabilities of the system. In spite of the expressive playfulness of the system, our interview and log data demonstrated, that the vast majority actually did express their true opinion, instead of only engaging with the interactive features of the installation [11] and/or voting randomly [33]. Furthermore, while previous work reflected on the problem of predominantly off-topic or random communication via a participative system [29], our observational findings showed that *MyPosition* was able to communicate a socially-motivated topic and spark vivid discussions among the people on-site.

Design Implications: There could be several strategies to support a good balance between playfulness and meaningful participation. On one hand, it should be fairly easy and quick way to contribute *meaningfully* (in our case, submit an opinion, which is then reflected in the visualization), while at the same time misuse is relatively restricted. Indeed, there were very few instances, we observed visitors to engage in publicly ‘challenging’ the opinion distribution by submitting twice for opposed options in order to e.g. “do a two-fold manipulation of the results”. While we tried to restrict that by only allowing a tracked user to participate once, we could not provide for a more sophisticated solution (such as face detection) due to ethical reasons. Even initially random behavior with *MyPosition* (observed in only one case,) was quickly followed by a loud reflection in terms of the visibility of the opinion, which suggest that the visible persistency of one’s contribution, might also lead to a more ‘considered’ behavior.

Public Character of Polling

Participating was public in two regards. First, the polling mechanism implied an ‘*immediate publicness*’: the participants were very visible to a large audience in the deployment space. Second, participants’ images (in the *image* mode) could be associated with their opinions for the time of the deployment (see “*The Identifiable Self*”). Despite this ‘immediate publicness’, a large percentage of all passers-by (6.1% in *color* mode) did submit an opinion. However, participants often stated that they would prefer a less public setting in the case of more controversial questions, suggesting a less exposed hallway, or a shorter interaction time.

Design Implications: One possible concern is that when publicly expressing one’s opinion, people could participate in a more ‘socially appropriate’ way. While we did not observe people stating a different opinion than what they actually submitted (agreeably, we cannot know their true opinion), people with a more controversial opinion may have not submitted an opinion in the first place.

Socio-spatial Patterns of Participation

Previous work has discussed individual and social group engagement in front of, along, and in close vicinity of interactive public screens [23, 27]. We observed participative behavior in a much wider area than the interaction zone of *MyPosition* (Fig. 7). While direct participation was possible in a relatively narrow area in front of the projection, various individual and group behavior patterns emerged in relation to the installation, such as social learning, teaching, discussion and nudging. While we observed social learning mostly relatively close to the screen, discussions and nudging happened up to very large distances away from it. Those were mostly the spots, where people obtained a good view of the screen, but were relatively far away from the interaction area. While these spatial specifics relate to the “activation spaces” proposed by [10], we observed that for spaces to be advantageous for *active* participative behaviors, they ought to provide the adequate social setting for a longer encounter with installation. The queue in front of the coffee shop, for instance, implied a waiting and a gathering situation, where several people were able to contemplate and debate around *MyPosition* together, without feeling awkward or exposed. Similarly, some people seemed to avoid the interaction area, and rather congregated around columns and other “comfort spaces” [10] out of the camera view.

Design Implications: Our findings demonstrate that an interactive public display, featuring a collective depiction of individual participative efforts can influence a much larger area than the interaction zone itself. However, it is important to provide spaces for active engagement with the installation, such as social discussion, that possess both proper visibility and social affordances, yet don’t intersect with the interaction area.

Limitations

Obtaining the ‘true’ opinion of citizens in a public context is characterized by many pitfalls, and we did not aim at collecting a representative polling result. Rather, we focused on how *MyPosition* was able to entice civic discussions and reflections on a locally relevant topic. In this sense, our conversion rate of 5% is comparable or better than conversion rates reported by other public display studies [38]. This emphasizes its usefulness for polls that are more playful and situated, however less ‘representative’ in nature. Furthermore, the objective of our field study was high ecological validity, so naturally, using this method we cannot generalize the results to other settings and questions. The university context might have provided a more friendly audience (e.g., more ‘tech-savvy’ people, ‘safer’ environment etc.), than for instance the grocery store investigated in [35].

CONCLUSION

Through the design and evaluation of *MyPosition*, we learned that an interactive public visualization of a local concern can be a means for civic discussion. Admittedly the inherent issues of polling in public (e.g. peer pressure, reluctant acceptance of intermediate results) cannot be avoided. In spite of this, increasing the visual identifiability of participants positively impacted the overall enticement of

onlookers to engage with the installation and the underlying topic, however lowered the actual turnout. At the same time, the playful nature of the interaction did not seem to deter people from submitting their stated opinion. We observed considerable discussion and nudging among people, in particular beyond the interaction area in front of the screen. In future studies, it would be worthwhile to further investigate the impact of the context, such as the socio-demographic characteristics of the audience, and to study if such systems can be augmented with more societally grounded questions and more elaborate, qualitative ways of answering.

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