IncluCity: Using Contextual Cues to Raise Awareness on Environmental Accessibility

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ABSTRACT
Awareness campaigns aiming to highlight the accessibility challenges affecting people with disabilities face an important challenge. They often describe the environmental features that pose accessibility barriers out of context, and as a result public cannot relate to the problems at hand. In this paper we demonstrate that contextual cues can enhance people's perception and understanding of accessibility. We describe a two-week study where our participants submitted reports of inaccessible spots all over the city through a web application. Using a 2x2 factorial design we contrast the impact of two types of contextual cues, visual cues (i.e., displaying a picture of the inaccessible spot) and location cues (i.e., ability to zoom-in the exact location). We measure participants' perceptions of accessibility and how they are challenged to consider their own limitations and barriers that may also affect themselves in certain circumstances. Our results suggest that visual cues led to a bigger sense of urgency while also improving participants' attitude towards disability.

Categories and Subject Descriptors
H.5.m [**Information Systems**]: Information interfaces and presentation (e.g., HCI) – *miscellaneous.*

General Terms
Human Factors.

Keywords
Contextual cues; inclusion; disability; accessibility; civic engagement.

1. INTRODUCTION
Promoting public awareness of accessibility issues and the barriers people with disabilities face in their daily lives is crucial for societies that aim at securing equality among their citizens. According to the Convention on the Rights of Persons with Disabilities of the United Nations, equal access to urban infrastructure is vital for enabling an independent life and constitutes a basic human right [34]. This include physical infrastructure such as buildings and transportation, but also information and communication infrastructure that is instrumental to enabling full participation of a citizen in societal activities.

Raising awareness on this issue remains a challenge, as it requires change in people's perceptions and attitudes towards disability. People who have not encountered any form of limitation due to permanent or non-permanent disability tend not to consider this condition as relevant to them [8]. Consequently, they may not be strongly motivated to contribute towards improving the inclusiveness of urban infrastructure [8], and view accessibility measures taken by the authorities as only relevant for a particular citizen group.

However, according to the International Classification of Functioning, Disability and Health (ICF) [37], disability is no longer to be seen as a permanent state that derives exclusively from the individual, but rather the result of a dynamic interaction among the individual's health condition and contextual factors, environmental (e.g. social attitudes, infrastructures) as well as personal (e.g. age, socio-economic background). Through this "*biopsychological* model" of disability, ICF proposes a comprehensive understanding of the phenomena in its complexity by synthesizing both the medical and social view on disability. An important contribution of this approach is highlighting the possibility that everyone may become temporarily disabled, and it *"'mainstreams' the experience of disability and recognizes it as a universal human experience*." [37]

Thus, we face a two-fold challenge. On the one hand we seek to raise awareness of the fact that all of us may at a certain point experience some form of temporary inaccessibility in an urban environment, while on the other to sensitize people to the barriers that others face due to inadequate infrastructure. Hence, this motivates us to develop mechanisms that can provide people with contextualized information on accessibility.

We argue that such mechanisms may be more effective than the abstract information that is often present in accessibility campaigns. Such awareness raising campaigns can sometimes fail by not challenging citizens' beliefs as the information provided is not related to their everyday environment and their own past experiences (e.g. [21, 27]). For instance, we argue that motivating people not to park in front of accessibility ramps can be more successful by showing someone a photograph of such an instance from their own neighborhood rather than a photograph from a location unknown to them. The former helps individuals relate to people with disabilities but also to recollect and reflect previous experiences in their lives.

Contextual cues have been shown to help tap into individual's episodic memories [33] by allowing mentally "re-living" specific life experiences and improve recollection by thinking back in detail to past personal experiences [30]. Additionally, when reflecting on these recollected memories the value is no longer re-living past events (as in recollecting) but in seeing things anew and framing the past differently [17]. We expect that through reflection, boosted by situatedness, individuals will further relate to the barriers faced on a daily basis by people with disabilities.

Thus, our goal in this paper is to develop a mechanism to give our participants accessibility information that is contextually related to them, and assess whether that taps into their past experiences. In other words, we seek to show them contextual information from their own neighborhood, work place, places they spend time

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in, and experiences they had with people with disabilities in those places. By allowing people to zoom in on inaccessible locations and/or see pictures of these spots, we expect a greater impact on people leading to willingness for greater engagement for the development of environmental facilitators across the whole city.

2. BACKGROUND

The World Health Organization [37] has attempted to expand the notion of disability as a dynamic phenomenon that can affect anyone to a varying extent. This view is shared by universal design [20] and the inclusive approach on urban design [5, 16] that aims at improving the structures, practices and policies of cities in order to secure a welcoming environment for all citizens and respond to their various needs [26].

Prior research has also shown that the predominantly negative attitudes towards people with disabilities are one of the dominant barriers towards their successful integration into society [1, 3, 25]. Hence, overcoming barriers towards inclusion requires not only a change of infrastructures, but also a change in thinking about disability [6, 26]. In essence, societal attitudes are partly reflected in social policies. In fact, societal attitudes theory supports that public attitudes influence to a considerable extent social policy making [18]. It is meanwhile broadly accepted that negative public attitudes are a big obstacle to overcome, and that it requires the support of citizens' movements to motivate processes of challenging existing perceptions of disability.

Remembering aspects of a past experience can serve many practical purposes; examples include locating lost physical objects by mentally retracing our steps, recollecting faces and names by recalling when and where someone was met, or remembering the details of what was discussed in a particular meeting [30]. In this case, we believe that we can assist participants in remembering previous experiences in which they faced accessibility problems or saw others experience these same difficulties due to physical constrains or bad infrastructure. Additionally, reflection can be used to examine patterns of past experiences, which may provide useful information about general level of physical activity or emotional states in different situations, allowing the person to relate to other data [30]. Alternatively, reflection might involve looking at one's past experiences from different angles and perspectives, which can be important in making people empathize with problems others face.

Furthermore, literature suggests the use of digital cues as appropriate contextual cues because our memory is a reconstructive process mediated by triggers from everyday events [2, 9]. The most used types of digital cues are visual cues [24, 35] or location cues [36], which can trigger everyday recall and promote attentiveness. So it was important that we provided a way in which these cues would affect our participants but also, as previous research suggested [22], combine both in order to assess if it would further allow people to better situate past activities in context.

Finally, there have been a few other environmental accessibility reporting systems that also work through crowd-sourced geo-referenced databases, such as CitiRoller (www.citiroller.com) and Wheelmap (www.wheelmap.org). In both cases the system uses location cues but not visual cues through the use of pictures at the actual wheelchair inaccessible spots. In this paper, we explore this added feature and contrast the differences between several presentation schemes with different levels of contextual cues present.

3. STUDY

Our field study aimed to assess how different ways of displaying information can affect the persuasive power of a message and potentially contribute towards changing attitudes of the participants. We hypothesize that the presence of contextual information, specifically visual cues (i.e., pictures of the inaccessible spot) and location cues (i.e., ability to zoom-in the exact location) will lead to:

a. Increased participation through recollection and reflection as suggested by previous studies [15, 22]. Increase in the number of reports through the use of contextual cues to increased participatory motivation.

b. Increased awareness of environmental barriers and inaccessible spots, which in turn leads to increased empathy towards people with disabilities [3, 25, 28].

c. Raising participants' awareness of the possibility of experiencing temporarily a form of disability or restriction in participation in certain situations by triggering episodic memories [9, 33].

3.1 Study Design

We manipulated two variables: the presence of the zoom functionality and the presence of pictures when browsing a map intended for adding new inaccessible spots, leading into a 2x2 design with 4 conditions (Table 1): Control, Zoom, Picture, Zoom/Picture. We instructed participants to take pictures of inaccessibility locations around town to serve as "proof" and then later login to our web application using a desktop machine to upload their reports. Each participant was allocated to one of four conditions that manipulated the user interface design and interaction mechanisms available in our web application (Table 1). After logging in participants were presented with a Google Maps interface which had all reports from all conditions and with the following functionality:

- see their own and others' reports: depending on the condition the participant was shown or not shown a photograph of the inaccessible location, and could or could not zoom into the map to get granular information about the exact location (see Figure 1 top, and Table 1). Participants could always see the address and comments added to any given inaccessible spot.
- add a report (see Figure 1 bottom) using a form which was identical for all participants. To add a report participants could zoom to guarantee accurate pinpointing of the marker, rate the severity of the inaccessible spot (Low - Green Marker, Medium – Yellow Marker, High - Red Marker), leave a message, and upload a picture of the location, which all these were mandatory in all conditions for consistency.

Those within the Control and Zoom conditions were able to see their own pictures but never those submitted by other participants. We decided to allow this as to avoid participants to begin to question the value of their photographs and efforts in the system. This is particularly important, as uploading a picture was one of the requirements to be able to submit a report. Finally, the Control condition served as an example of an awareness-raising campaign that provides information out of context.

Table 1. The conditions derived from our 2x2 design

	Picture absent	**Picture present**
Zoom absent	Control	Picture
Zoom present	Zoom	Zoom/Picture

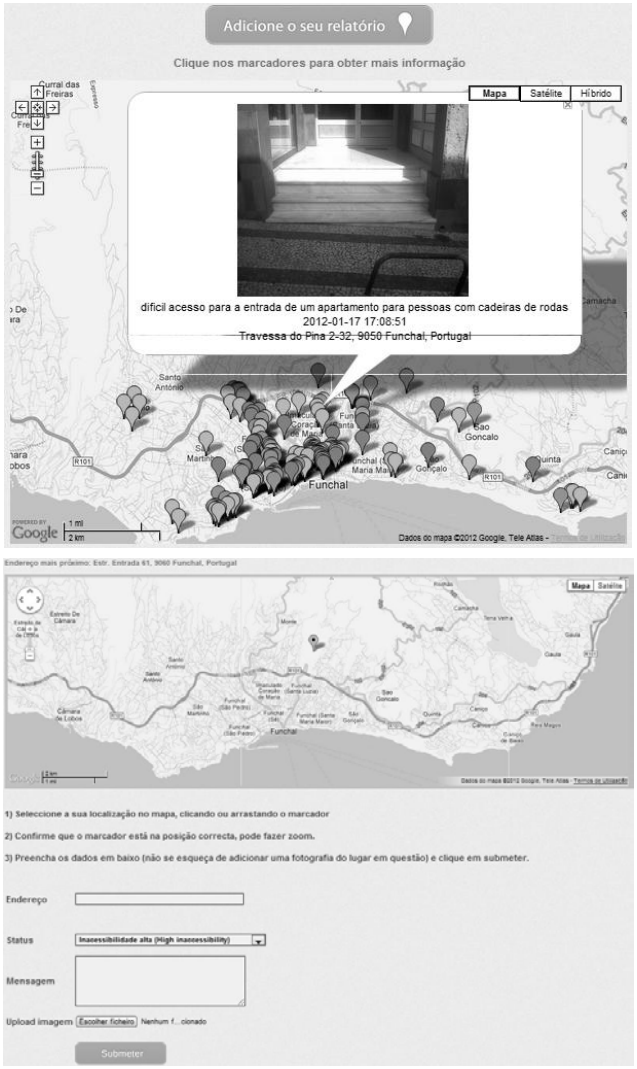


Figure 1. Top: The Zoom/Picture condition viewing a picture of a report about an inaccessible building. The Picture condition does not have the zoom widget, the Zoom condition does not show photographs uploaded by other users, and the Control condition has both types of restrictions. Bottom: Adding a new report was identical across all conditions.

3.2 Participants and Procedure

We recruited participants by placing posters at a University campus and several other locations around the city, as well as announcing the study in local online communities and online social networks. Furthermore, to guarantee that participants could only access their assigned condition, we implemented a login system that automatically redirected the user to the correct version of our web application. Participants initially registered by sending an SMS with the keyword "Register", and received a URL that directed them to an online survey. After completing the survey, each participant was redirected to the login page (where instructions and tips on how to use the system were also presented), and login credentials were sent to them.

This process ensured that participants answered our initial survey and that they were constrained to their assigned condition via their unique login details. In total 24 of our participants registered, completed the surveys and used the application at least once. Participants that did not complete the survey or never logged into the system were discarded. They were also informed that all reports would eventually be relayed to the local authority responsible for disability policies and infrastructures, and that four movie tickets would be raffled at the end of the study.

3.3 Measures

3.3.1 Behavioral Measures

All system interactions were logged. We measured a) the total number of reports submitted by each participant, b) the distribution of submitted reports over days, timestamp of reports, c) the severity of reports, i.e. frequency of green, yellow, red markers for each participant and for each condition, and d) the length (in characters) of each report.

3.3.2 Surveys

Participants responded to an online survey at three points in time: before obtaining login credentials (week 1), after 1 week of use, and after 2 weeks of use. Demographic information such age, gender and occupation were obtained during the initial survey only. Questions that were repeated across all surveys were:

- phone number (so we could associate them with the reports done in the system).
- a 7-point Likert scale indicating their current opinion regarding accessibility in the city. Our expectation was that, as the study progressed, participants would become more aware of the city's accessibility barriers and therefore progressively lowering their opinion, particularly those that had access to contextual cues.
- the number of inaccessible spots they remembered seeing during the past week. Our expectation here was to verify if our manipulations affected the attentiveness of our participants to inaccessible spots around the city.
- a 7-point Likert scale indicating if during the previous week they faced difficulties in performing a task because of own physical constraints or bad infrastructure. Our expectation here was to assess if our manipulations challenged our participants to think how inaccessibility affects them directly.

3.3.3 Interviews

All participants were invited for an interview following the completion of the study. Ten participants in total were interviewed (2 from Control, 2 from Zoom, 3 from Picture and 3 from Zoom/Picture). We started by asking why they decided to participate, what were their initial opinions on inaccessibility and people with disabilities, if they had any relatives or close friends with disabilities, and if so, did it influence the way they used the application. We then presented two submitted reports to each participant that s/he submitted throughout the past week (selected based on our subjective judgment of their novelty) and asked them to describe the context of these reports. Some questions we used here were: if that inaccessible spot was something they were looking for or was it spontaneous, why they sent that specific report, how they felt when they sent it, and if that barrier they identified also affected them directly.

We then followed with questions related more specifically to the condition they were allocated to. We asked if the information provided was enough to recall inaccessible spots (as well as why or why not), if they found the feature(s) available in their condition helpful in triggering memories of inaccessible spots they have seen in the past, and if the visualization of the reports motivated them to collect more locations and if so in what way. Finally, we inquired about other means people could provide

inaccessibility reports. Through these contextual interviews we capture individuals' motivations for submitting reports, how our manipulations affected them, as well as if their attitude towards disabilities and inaccessibility had changed and finally their overall opinion on the study. All interviews were conducted face-to-face lasting 15 to 20 minutes each.

4. RESULTS

We distributed the 24 participants across the four conditions. All participants completed the pre-survey, mid-survey and the post-survey. The participant pool consisted of 18 (75%) males, and the average age of all participants was 24.83 (SD=2.44). Most participants were students (N=15, 62.5%) while the other nine participants (37.5%) reported various professions. We received 154 reports (86 in the first week, 68 in the second), distributed across conditions as follows: 26 (16.9%) Zoom, 50 (32.5%) Picture, 55 (35.7%) Zoom/Picture, and 23 (14.9%) Control. In terms of the severity of inaccessible spots of the reports we received there were 39 (25.3%) low, 62 (40.3%) medium, and 53 (34.4%) high. We note that only 2 participants reported having prior exposure to disability (1 in the Control condition and 1 in the Zoom/Picture condition).

4.1 Effects on Participation

We performed three separate one-way ANOVAs in which we compare participants' total number of reports during week 1 only, during week 2 only, and the total number of reports submitted by the end of the study. These tests revealed no significant effect of condition on the total number of reports submitted during week 1 ($F(3,20)=.52$, $p=.67$). However, we found a significant effect of condition on the total number of reports participants submitted during week 2 ($F(3,20)=4.68$, $p=.01$) and in the total number of reports by the end of the study ($F(3,20)=3.44$, $p=.04$). Bonferroni corrected post-hoc tests showed that there were only differences between conditions regarding the total numbers of reports during week 2. Additionally, the report length had no significant effect ($F(3,150)=1.82$, $p=.15$).

Participants in the Picture and Zoom/Picture condition contributed significantly more reports when compared to those in the Control condition ($p=.04$ & $p=.02$ respectively), but this was not true for those in the Zoom condition ($p=.83$). Figure 2 depicts the distribution of reports over the 14 days for all participants in all four conditions of the study. The differences between conditions become clearer during week 2 (days 8-14), even if the number of total reports declined (86 vs. 68).

Interestingly, participants from the conditions with visual cues reported that the pictures effectively triggered past memories of places they saw someone else having problems moving around or where they themselves faced difficulties. For instance, one participant from the Zoom/Picture condition said:

"It happened quite a few times, I would see a picture and remember situations in which I passed in that exact location and have problems in moving around".

When asked if he thought that the ability to zoom in actually helped with this recollection he said:

"Well a bit I guess, it would be kind of abstract without the picture though. I mean I would not be able to know for sure what location that person was referring to".

Another participant from the same condition also said that she had a family member that was using a wheelchair for an extensive period of time, and the pictures made her remember the difficulties the person had:

"When I saw places where my brother had problems getting to on his wheelchair it made me think. It also made me think of other places he had problems that were not on the website so I went there and took photos even of the entrance to our building".

Additionally, participants from both of these conditions were also more motivated to go out exclusively to find more inaccessible spots especially after a few days of seeing other people's reports. As one participant from Zoom/Picture condition said:

"After seeing so many pictures of spots I know which are inaccessible for people with disabilities I actually took an afternoon to search around town for other examples".

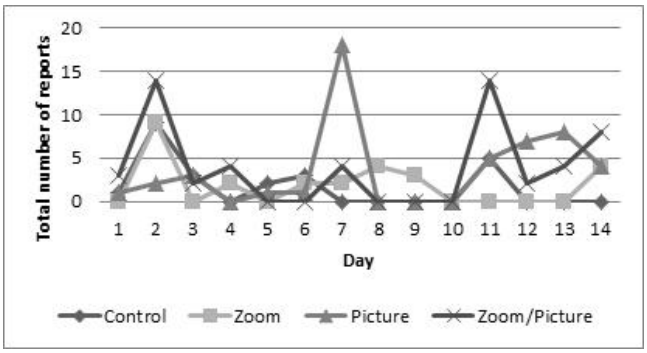


Figure 2. The number of daily reports given during the study for each condition.

4.2 Perceived Severity of Inaccessible Spots

As participants submitted reports, they were also asked to rate the severity of the spot's inaccessibility (low, medium, high). The distribution of severity levels for each condition is shown in Table 2. All participants were able to see all reports (albeit at varying level of detail) as well as the assigned severity.

Table 2. Distribution of severity levels reported per condition.

	Control	Zoom	Picture	Zoom/Picture
Low	9	14	9	7
Medium	8	6	25	23
High	6	6	16	23

We found a significant relationship between condition and the severity level participants reported ($\chi^2=21.35$, $df=6$, $p<.01$). In Figure 3, we see that low severity inaccessible spots (green markers) were more popular among participants in the Zoom and Control conditions. In contrast, we found that both conditions with pictures had a greater inclination to report medium and high severity inaccessible spots (yellow/red markers).

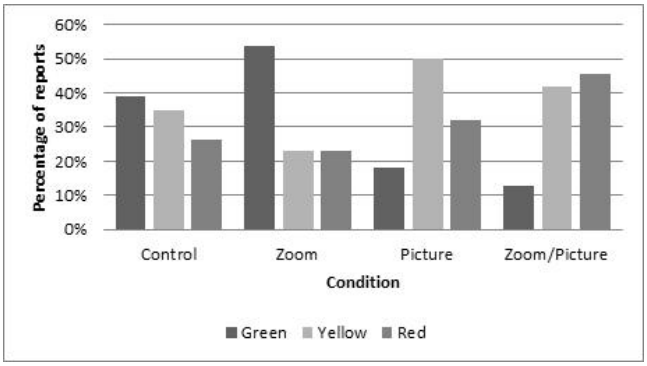


Figure 3. Assigned severity level across all conditions

4.3 Changes in Attitudes

One of our main interests was to assess if contextual cues could play a role in changing people's attitudes and sensitize them to the barriers that people with disabilities face on a daily basis. This was done through the three surveys answered by the participants throughout the study plus the interviews.

First, we asked people to rate in a 7-point Likert scale their current opinion of accessibility of the city. A mixed-design repeated measures ANOVA showed that there was a significant interaction between condition and the answers given by our participants across the three periods ($F(6,40)=2.69$, $p=.03$). Figure 4 shows the progression of opinions about city accessibility for each condition over the three measurements done through our surveys. Furthermore, Bonferroni correction post-hoc tests showed that only the results between the Control and Picture conditions ($p<.01$), and the Control and Zoom/Picture conditions ($p<.01$) were significantly different.

Our results show that participants progressively lowered their opinion on how accessible the city actually is. However, for those with access to pictures this decline was more accentuated. This difference was also apparent during our interviews, in which a participant from the Picture condition said he never realized the city was so inaccessible:

"I had no idea the city had so many inaccessibility problems! Checking people's pictures and reports really opened my eyes",

while a participant from the Control condition stated when asked if his opinion of the level of accessibility of the city changed during the study:

"Not really, I still think accessibility here is decent with a few problems that exist everywhere I guess".

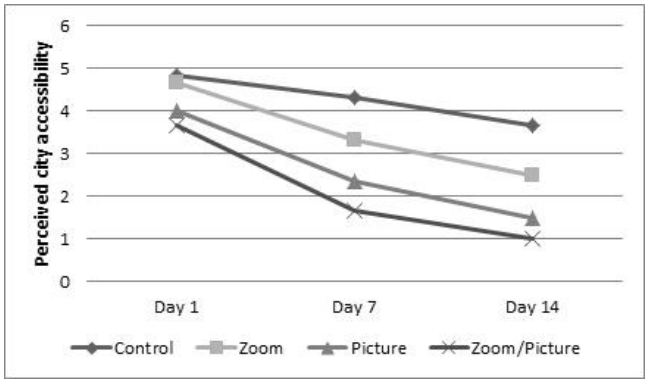
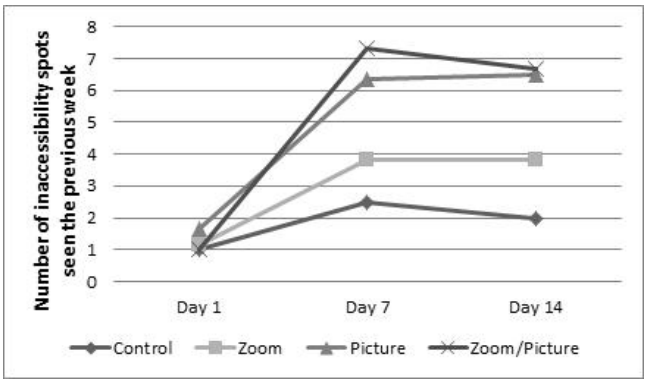


Figure 4. Answers given by our participants (7-point Likert scale) in which we asked them to rate the level of accessibility in the city for our three surveys across all conditions).

Figure 5 shows the progression of the amount of inaccessible spots participants remembered seeing during the previous week over the three measurements done through our surveys. A mixed-design repeated measures ANOVA showed that there was a significant interaction between condition and the answers given by our participants across the three periods ($F(6,40)=6.4$, $p<.01$).

Furthermore, Bonferroni correction post-hoc tests showed that the results between the Control and Picture conditions ($p<.01$), Control and Zoom/Picture conditions ($p<.01$), Zoom and Picture conditions ($p=.02$), and Zoom and Zoom/Picture conditions ($p=.01$) were significantly different. The results show that participants with access to pictures became more attentive about inaccessible spots around the city than those in the other conditions and also participants across all conditions appeared to have retention behavior, as there are little differences between week 1 and 2. One participant from the Picture condition pointed out that by seeing pictures of a location he passed by frequently made him more self-aware of these problems and he stated that:

"After seeing some pictures of an area I pass by almost every day to go to the university, I started to pay more attention whenever I went out".



. **Figure 5. Answers given by our participants regarding how many inaccessible spots they remembered seeing during the previous week for our three surveys across all conditions.**

Figure 6 shows the progression of how participants felt about mobility problems taking into account their own physical constraints or problematic infrastructure. A mixed-design repeated measures ANOVA showed that there was a significant interaction between condition and the answers given by our participants across the three periods ($F(6,40)=4.95$, $p=.01$). Furthermore, Bonferroni correction post-hoc tests showed that only the results between the Control and Picture conditions ($p=.03$), and Control and Zoom/Picture conditions ($p<.01$) were significantly different.

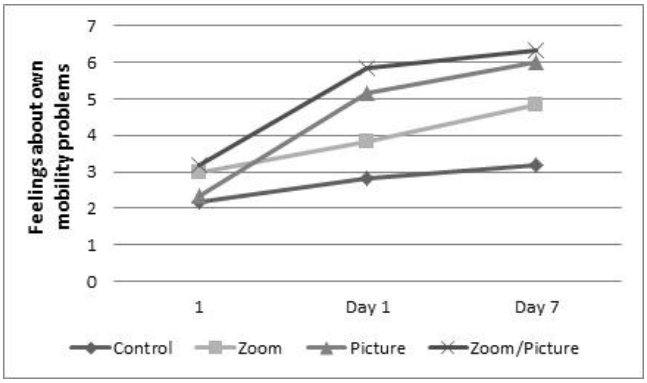


Figure 6. Answers using a 7-point Likert scale on how participants felt about mobility problems they had, taking into account their own physical incapability or bad infrastructure for our three surveys across all conditions.

Overall, our manipulations were successful in challenging our participants to think how inaccessibility affects them directly. Those with access to visual cues reported a higher increase in this perception by having a bigger impact in showing to our participants the problems that can arise from inaccessibility. A participant from the Picture condition mentioned that he had never thought about how city infrastructure made life more difficult not just for people with disabilities but also for him:

"During the study I really started noticing that how badly some buildings are designed around town making it harder for everyone not just people with disabilities".

5. DISCUSSION

The results suggest that contextual cues had an effect on participation, the type of feedback given by participants, and their attitude and awareness regarding disability and accessibility issues. All interventions were contrasted against each other and a control group that attempted to mimic current awareness raising campaigns that provide information out of context.

5.1 Using Contextual Cues

Our results show a clear and strong impact of contextual cues on participants regarding the use of pictures, but only during the second week of our study. We offer two possible explanations for the fact that we saw no significant difference between conditions during the first week of our study. First, initially there were no reports on the web applications, so it took some time to build up a sufficient pool of information that could then affect our participants. Second, the novelty effect may have also played a role in skewing the data during the first week with participants across all conditions being highly active on the initial days following deployment.

Furthermore, the fact that only pictures and not zooming had an effect on our participants agrees with prior theory that argues for the evocative power of images, whereas it is not necessarily the case that locational information has the same effect [2, 9]. One explanation can be that providing such visual cues could facilitate focusing on the important or unusual [14], while the same does not happen for location cues. Others have reported the importance of images in everyday memory [2, 10], so it was expected that image-centric presentation of inaccessible spots around the city would, as opposed to a location-centric approach, promote greater recall as reported in previous research [22].

Furthermore, people tend to remember visual information more easily than other types [7]. This enables them to use schematic knowledge about their own routines, people in their lives, familiar places [29], which in turn helped them identify reported inaccessible spots. As a participant from the Zoom condition mentioned he mostly does not know name of streets so exactly pinpointing a location did not motivate him in any way:

"When I did zoom I saw names of streets I did not recognize although I know the area very well."

To interpret our findings, we believe several processes are at work. Through the contextual cues, participants sometimes recognized the location of reports by other participants, immediately enabling them to relate to what was being reported. After recognizing the location, our participants went through a process of recollection of past events, which previous research has shown [23] can be strengthened by digital cues, hence allowing them to directly tap into their daily patterns. At this point, the pictures worked as a catalyst as a participant from the Picture condition said:

"Initially I was not even sure how I could even help but after seeing other people's reports and pictures on places I am used to go to something clicked".

This led to the final process, namely reflecting based on the now contextual cues about how it could affect him/her directly as well as others with and without disabilities. This interpretation accounts for why during our study pictures had a greater effect than zoom. With zooming, a person can potentially recognize a place, which will perhaps trigger past memories while pictures will enable the person to actually see the inaccessible spot therefore having a much larger impact on following processes. Interestingly, in some cases our participants claimed that visiting particular locations made them remember reports they saw on the web application, as a participant from the Zoom/Picture condition said:

"I found myself passing by places around city and remembering reports done in that place by other people".

Thanks to this bidirectional interaction participants were further motivated and reminded to take pictures and contribute actively to the system.

Furthermore, our results showed that participants from the two conditions with pictures had a tendency to report inaccessible spots as being of higher severity than the reports from the other two conditions. We believe this was caused by the fact that these participants became more aware of the issues at hand and therefore attributed a higher level of severity to their own reports. As one participant from the Picture condition stated when asked why he decided to use a red marker for a report he made about the entrance to a local shopping mall:

"I saw a picture of another mall that did not have ramps at the main entrance, so when I realized that the main shopping mall in the city also does not have ramps I took a picture. I just think it is very serious that we do not have wheelchair accessibility to a shopping mall".

5.2 Changing Attitudes and Raising Awareness through Contextual Cues

Our results indicate that pictures also had a significant effect in changing participants' attitudes towards disabilities and raising awareness of these barriers. While participants from all conditions reported a decrease in their opinion of how accessible the city is during the study, those that had access to pictures had a significantly bigger decline. Orthogonally, we saw a jump in the reported amount of inaccessible spots seen by the participants the previous week in all conditions by the end of week 1 maintaining more or less the same quantity at the end of the second week. However, in the visual cues conditions the jump was more accentuated. We note that this is the participants' perceived amount of inaccessible spots seen, and might not be a reliable measure. Even if this was the case, the differences in perceptions between those with access to pictures and those without are still noteworthy.

Furthermore, participants across all conditions reported becoming more aware of own mobility restrictions caused by physical constraints or/ and problematic infrastructure. The two conditions with access to pictures were again the main contributor to this increase. The results show that pictures had a bigger impact in changing peoples' attitudes and awareness as opposed to location cues.

These changes in attitude are of crucial importance, since failure in eliminating environmental barriers and providing facilitators for accessibility, inevitably inhibits the participation of people with disabilities in educational, social, recreational and economic activities [31]. It is also the case that accessibility modifications to the environment often enable others, who are not restricted by a particular disability to access their environment even more readily. A participant from the Zoom/Picture condition pointed out that he now realized that his own mundane everyday tasks were made more difficult by the fact that his building is not adequately designed for people with and without disabilities:

"My building doesn't have elevator and I live in the third floor so every time I go shopping it is hard for me to go up the stairs with

all the bags, so I think in that case by making it accessible to people with disabilities would make my life easier too."

We also identified a trend after a few days of deployment in which, after one participant reported a couple of inaccessible churches, a significant number of similar reports by other participants started to appear showing various churches across the city. A participant from the Picture condition expressed how these contextual cues made him reflect:

"To be honest I never even thought about it but seeing those reports made me feel bad, so I went and took pictures of other church entrances that had not been reported yet. To my surprise they were all like that, we live in such a religious place and we do not even offer wheelchair accessibility to citizens with this restriction".

This community-driven reflection phenomenon we see here is another example of how contextual cues can be a powerful tool in raising awareness about barriers within a community.

5.3 Implications

We argue that reporting tools that use contextual cues can be a powerful medium to suggest improvements in several aspects of society. For instance, they can be used to educate people and raise awareness about accessibility problems, in our case inaccessible spots also affecting people without disabilities.

Additionally, often the work performed by officials alone may not be comprehensive enough, as they might not have experienced all required places nor can they look at the world through the eyes of the people with disabilities. It is not uncommon that the people responsible for mapping disabilities do not have enough resources in their disposal to conduct large-scale campaigns necessary for accurately mapping environmental barriers in cities. This was verified in our discussions with a city official working on similar matters, and likely applies to other aspects of urban planning as well as other areas in which community-based feedback would be useful [19]. However, we argue that for such community-based feedback systems to function there is a need for it to possess enough persuasive power to keep its user engaged and motivated as demonstrated in previous studies [11, 12]. Contextual cues are another way to achieve this.

Previous research has also shown that pictures can be an effective way to record a "living history" of a city [32]. It could present itself as an opportunity to allow citizens to see the before and after by showing how specific problems were fixed. This would then allow the community to reflect back on certain situations. Such "history bank" systems could then be used to better evaluate changes made as a result of previous feedback. Ultimately, this would give users a reason to keep coming back and maintain an on-going dialog with those responsible for such systems.

5.4 Limitations

We acknowledge that the web applications used here are not ideal for the purpose they were utilized, i.e. harnessing the local community to collect inaccessibility reports. They lack advanced social features and force users to submit pictures, making submissions impossible when users do not have any images available of the inaccessible spot. However, pictures were imperative for us to measure the effect of images to the use of applications and to user behavior and attitude during the study.

Secondly, we acknowledge the fact that for such a between subjects design ideally one would want more participants in each condition to make the results more reliable. Despite this, we are confident that our interventions had the effect described due to our qualitative data, namely the surveys done in three distinct timeframes and the insightful comments given by our participants during our interviews. Additionally, the work presented here was done in-the-wild and with an audience that cannot be fully controlled. When reporting our results, we follow Brown's advice [4] and move beyond an across-the-board artificial success: rather than proposing a solution that fulfills all the needs of all involved stakeholders, we report what happened with the chosen solutions in a complicated social setting.

Lastly, none of our participants were facing disabilities themselves. Having participants with disabilities in a study would yield richer insights to the variety of accessibility problems that people without disabilities would find hard to think of or spot in their everyday surroundings. However, it was beneficial to have common ground among our groups, as results might have been skewed if we had some people with disabilities in only some of the conditions. We also note that only 2 of our participants had prior exposure to disability through family members in 2 different conditions and therefore we do not expect this to have been a confounding factor in our results. We do however emphasize the importance of controlling this potential confound in future work on this topic.

6. CONCLUSION

We have presented a study aimed at challenging people's perceptions of disability and accessibility. In particular our study explored the effectiveness of visual and location cues on having a persuasive effect on people. We found that contextual cues had significant effects on the level of participation exhibited throughout the study, the type of feedback given by participants, and their attitudes towards disability as well as awareness of environmental barriers to accessibility.

Engaging and keeping people interested is a challenge that many service providers and campaigns have tried to address for a long time. Our study shows that contextual cues, particularly visual cues, can be a powerful tool in making people better relate with what is being presented to them and therefore become more engaged.

We expect that the increasing abundance of contextual cues, for example in the form of photographs and media shared and tagged in online social networks, can act as pool of highly contextualized social media. While in the past advertisers and promoters have used "generic" material to capture people's attention and change their attitudes, we believe that a more effective approach is to rely on contextualized material that can be used to target specific groups of people as shown, for instance, in social media [13]. We have demonstrated this in the context of challenging people's perceptions on accessibility, but it is certainly interesting to explore whether this holds for other domains, such as healthy living and energy consumption.

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