Exploring How Visualization Design and Situatedness Evoke Compassion in the Wild

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Figure 1: *Visualization that represents harassment stories that occurred in a public space.* `Left` *– Marks shown in detail: three glyphs representing different stories.* `Center` *– The visualization and its legends: each pot corresponds to a specific harassment type (stalking, catcalling, sexual violence, etc.) and contains several stories.* `Right` *– Participants are engaging with the visualization where the harassment cases occurred.*

Abstract

This work explores how the design and situatedness of data representations affect people's compassion with a case study concerning harassment episodes in a public place. Results contribute to advancing the understanding of how visualizations can evoke emotions and their impact on prosocial behaviors, such as helping people in need. Recent literature examined the effect of different on-screen data representations on emotion or prosociality, but little has been done concerning visualizations shown in a public place – especially a space contextually relevant to the data – or presented through unconventional media formats such as physical marks. We conducted two in-the-wild studies to investigate how different factors affect people's self-reported compassion and intention to donate. We compared three ways of presenting data about the harassment cases: (1) communicating data only verbally; (2) using a printed poster with aggregated information; and (3) using a physicalization with detailed information about each story. We found that the physicalization influenced people to donate more than only hearing about the data, but it is unclear if the same applied to the poster visualization. Also, passers-by reported a likely small increase in compassion when they saw the physicalization instead of the poster. We also examined the role of situatedness by showing the physicalization in a site that is not contextually relevant to the data. Our results suggest that people had a similar intention to donate and levels of compassion in both places. Those findings may indicate that using specific visualization designs to support campaigns about sensitive causes (e.g., sexual harassment) can increase the emotional response of passers-by and may motivate them to help, independently of where the data representation is shown. Finally, this work also informs on the strengths and weaknesses of using research in the wild to evaluate data visualizations in public spaces.

CCS Concepts
• ***Human-centered computing*** → ***Empirical studies in visualization;***

1. Introduction

Data representations have often been used to evoke compassion in data journalism and activism [Per13, FP16, MMS20]. A range of specific design strategies are often leveraged to increase compassion, including increasing the richness of information per data point, representing individuals in data marks, and creating physical art installations that represent data [MJAD20]. However, in contrast with the widespread use of those design strategies, little is still known about the extent to which they affect emotions or behavior.

This study contributes to advancing the literature of Anthropographics, visualizations that represent data about people in a way that is intended to evoke feelings such as compassion or behaviors such as helping people in need. Previous findings [MJAD21] suggest that representing people's data more individually and with more details might influence participants' emotions and donations. Related work [MJAD20] also hypothesizes that using physical marks and showing the data in a place that is contextually relevant might also affect compassion. Despite recent studies that empirically explored on-screen visualizations [BPE*17, LPW20, MJAD21], no work has investigated the role of physical [DJM20] or situated [WJD17] data representations on people's compassion in a naturalistic scenario.

We conducted two in-the-wild studies to investigate whether unexplored visualization designs affect people's self-reported compassion and intention to donate. We used data about sexual harassment incidents in a public space as a case study to explore contrasting design strategies. We first compared three ways of presenting data in terms of information-richness and physicality: (1) communicating data only verbally; (2) using a printed poster with aggregated information; and (3) using a physicalization with detailed information about each story. Additionally, we examined the role of situatedness in the second study. Results from our studies reinforce previous findings and shed light on new discoveries.

Our results suggest that displaying a physicalization with detailed information about the harassment cases may evoke higher levels of compassion when compared to using a poster with aggregated information. However, participants tended to express a similar intention to donate in both conditions. Conversely, when comparing the physicalization with informing the data verbally, participants wished to donate more when the visualization was present. Finally, we also found that people have a high intention to donate when they see the physicalization, independent of whether it is exhibited in a contextually relevant place or somewhere else.

Besides the main findings, this work also brings additional contributions to the literature of Data Visualization. First, it informs researchers about the strengths and weaknesses of using research in the wild to evaluate visualizations. Second, it also discusses the design and deployment of physicalization in public spaces. Those contributions inform the further design and methodological approaches for data visualizations.

2. Background

This section discusses Anthropographics and Research in the Wild.

2.1. Anthropographics

Designers have been proposing visualizations to evoke emotions for a while, but researchers only started to study them in the past few years. Such visualizations, called *anthropographics* [BPE*17], initially consisted of data representations composed of human-shaped marks, which are "visual strategies [intended] to make the connection between data and the humans behind them more direct and, hopefully, more empathic" [Ber17]. This work considers anthropographics as "visualizations that represent data about people in a way that is intended to promote prosocial feelings (e.g., compassion or empathy) or prosocial behavior (e.g., donating or helping)" [MJAD20]. This last definition is more inclusive since it also encompasses visualizations that are not composed of human-shaped marks (e.g., [Sca11, Lup18, MMS20]).

Studies about anthropographics are still scant. Prior work evaluated the effect of anthropographics on participants' empathic concern and donations [BPE*17] or their attitudes towards a topic [LPW20], but results were inconclusive. A recent work formalized concepts and extended the design space of anthropographics, pointing out dimensions that might evoke compassion [MJAD20]. Another study that investigated an on-screen anthropographic with human-shaped marks and partially identifiable information suggests that those designs might evoke mild compassion levels. However, other design space dimensions (e.g., physicality or situatedness) are still unexplored.

2.2. Research in the Wild

Research *in the Wild* (or RITW) is an umbrella term commonly used in HCI to refer to studies conducted in naturalistic settings [CCG*13]. RITW has been heavily used in HCI and Visualization studies, especially those related to public displays or physicalizations [DDK17]. Artifacts were deployed in different environments: family houses [SBMH20], semi-public places [MASP19, PCG*20, VJTVM13, HBG*19], or on the street [CVM13, CM15]. Unlike lab studies, where the environment and tasks are heavily controlled, RITW allows participants to explore a device or visualization without clear tasks, as happens in real-world contexts. This approach ensures more ecological validity since the environment and conditions where the study occurs are close to what users would experience in practice [RM17]. On the other hand, the method provides less controlled conditions.

An alternative to mitigate the issue of having limited control over the experiment is conducting controlled research in the wild (CRITW) [CWSVM15]. This approach consists of deploying the artifact out of the lab following a more pragmatic research protocol. The CRITW was evaluated against the RITW, where participants engaged with three types of public displays and evaluated them according to their engagement and insights. Participants had a similar performance in both methods, suggesting that CRITW is promising. However, the literature still lacks works that inform the methodology and experience of conducting controlled research in the wild, especially for physical or situated visualizations.

3. Harassment Plants: an Information-rich Physicalization

This section discusses the conception of the Harassment Plants, a visualization designed to evoke compassion towards victims of sexual harassment. We clarify the design decisions and evaluation made before the studies.

3.1. Motivation

The visualization's concept was initially motivated by the observation that women tend to avoid certain places at specific times due to safety concerns [Val89]. Since this issue seems to be seldomly acknowledged in datasets, in the media, or our everyday life [DK19], we decided to present data about the proportion of visits between women and men in a public space. The idea was to make passers-by empathize with women's concerns in a public lakeside called Açude Velho.

Before designing the visualization, we discussed with six undergraduate students their experiences as women in Açude Velho to investigate the topic's relevance. Surprisingly, participants suggested that women who visit Açude Velho are not chiefly concerned that they are a minority in the space; they are more worried about the danger they experience there. Participants were more interested in discussing concrete and thoroughly described situations of harassment that they went through in the place. This discussion motivated us to change the topic and present data about sexual harassment cases with the aim of making passers-by more compassionate about the victims.

3.2. Dataset

To visualize the harassment cases, we created a dataset based on the reports collected from women at Açude Velho. We collected data from 27 random women, aged 18 years or more, passing by Açude Velho between April and May 2018. A researcher approached women and invited them to participate in a research without specifying the purpose. If the person agreed, she would be asked whether she had ever been bothered by men in the space. This question motivated women to talk more openly about the subject and answer follow-up questions. The questions were captured by a second researcher who was in charge of taking notes of the interviewee's responses and reactions. The points captured were the approximate time and place where the harassment episodes occurred and the incident's overall description. We categorized the unstructured answers into categorical and ordinal variables by looking for patterns in the harassment descriptions. The final dataset served to create all the visualizations presented in this work. It is available at `https://osf.io/sm9jx/`.

3.3. Process Overview

The physicalization design followed an iterative process of creating intermediate visualizations similar to the concept of sandcastling [HF17]. The process consisted of creating paper sketches, discussing materials, implementing components, and testing prototypes. New designs were based on discussions and lessons learned from previous iterations.

3.4. Design Iterations

The Harassment Plants were based on a series of design iterations and thorough discussion. This section briefly describes each design proposal that led to the physicalization's final concept. The intermediate visualizations can be seen in Figure 2.

The **Cross-stitch Design** was inspired by Raquel Rodrigo's guerrilla knitting projects [Rod17]. The idea was to install panels where we collected the data. Cross stitches would represent the proportion of men and women along the hours and days. The researchers would cross-stitch new data points every day as new data was collected. We chose this technique and materials because they are aesthetically pleasing, and women have been using them to political resistance. We discarded this concept after changing the visualization's topic and data.

The **Harassment Balloons** were the first attempt to represent harassment reports. We used balloons since they are glanceable, affordable, and were used in previous data exhibitions (e.g., [Kle17, SS10, Dua11]). The initial concept would consist of one balloon for each harassment case but we discarded this idea because most women did not remember the exact location of the incidents. Another solution was deploying balloons together, with one large balloon for each harassment type. Each balloon would have a specific color and blink differently depending on the number of harassment cases. However, we later decided to present a visualization with more than that aggregated information since we were interested in testing the hypothesis that showing individual stories makes people more compassionate [Ros16].

The **Harassment Box** was a complement to the previous physicalization to allow people to know more information about each harassment story. We would install a box near to its corresponding balloon and, when people got closer, the device would narrate the harassment stories. While the overall idea of exhibiting balloons and boxes seems reasonable for private spaces, we found out that transporting and re-installing all technological components during every new exhibition was impractical for a public physicalization. Therefore, we aborted the current concept to try a simpler, cheaper, and more portable solution.

The **Harassment Plants** were designed to be compact and represent individual harassment stories. They were inspired by Giorgia Lupi's work [Lup17] by representing data as abstract shapes, difficult to read at a glance. We expected that slowing down the reading experience would allow people to relate more to the stories since increasing the visual difficulty in charts might affect people's information retention [HAS11, BCF20]. We chose the metaphor of plants with flowers because it refers to the idea that the harassment cases are part of the environment (which contains other plants and decoration) and flowers are part of the design space of data glyphs [FIBK16]. Each plant represents a harassment story. The stem's height means the approximate time that the harassment incident occurred, and each bead corresponds to a different aspect of the story (see Figure 4). Plants are gathered in pots representing different harassment categories through a colored semisphere in the middle. The semispheres contained a LED that blinked according to the number of cases. However, we removed the LED after a pilot test. Finally, we used beads and wire to compose the physicalization because they are cheap and easy to handle.

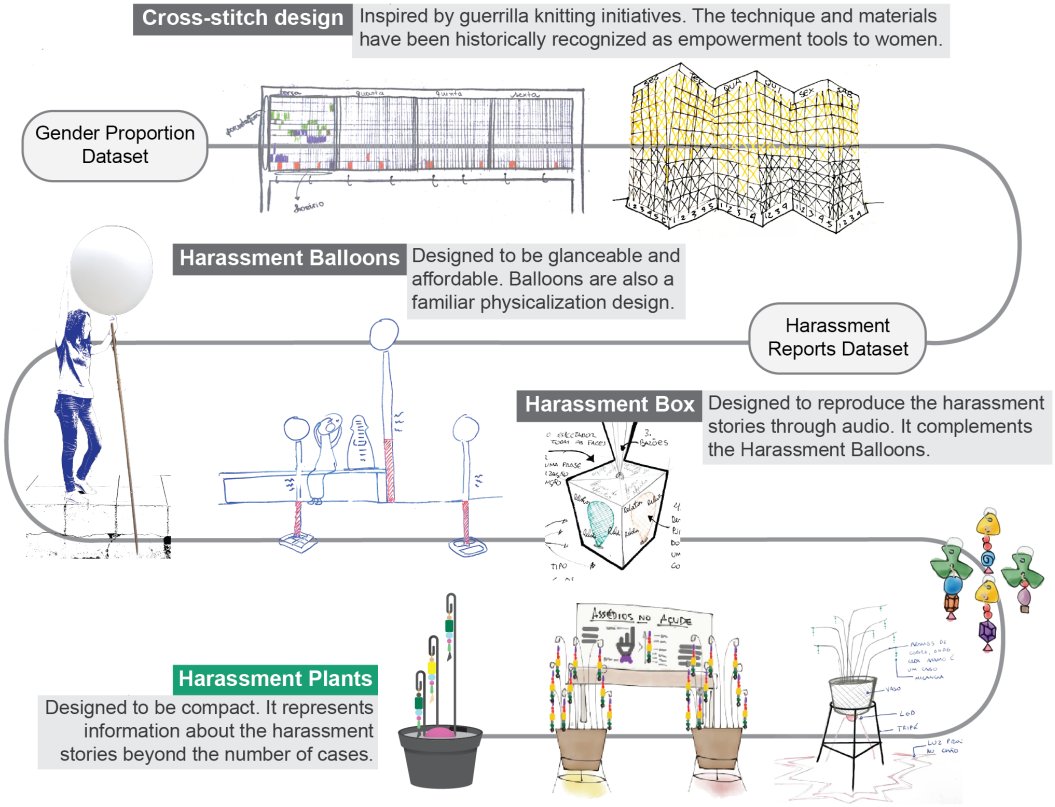

Figure 2: *The physicalization's design iterations. The thread follows a chronological order from the initial dataset and sketches until the Harassment Plants' final concept. The drawings and photographs were created during the design process.*

3.5. Evaluation and Refinement

We investigated the Harassment Plants' usability to identify and correct design issues before the actual study. We installed the visualization three times in different spots of a university's square and observed how passers-by engaged with it. One of the authors jotted down his perception of people's reactions and asked participants about their impressions of the visualization after the engagement. Our findings suggested that the audience could understand the physicalization, and engagement varied greatly depending on where the visualization was placed. This result reinforced the idea that we should exhibit the Harassment Plants in crowded spots to increase the chances of engagement.

This preliminary evaluation also helped us identify technical issues. We realized that the LED's blinking pattern did not add up much value to the physicalization. Participants did not seem particularly interested in the LED behavior, and some of them reported not having realized the lights, probably because their brightness was not perceptible in daylight. Another disadvantage of the LED is that we would need to install it during every new exhibition, which would take a considerable amount of time. Thus, we removed the electronic components in the final design since they did not help increase people's awareness, and doing so facilitated the physicalization's deployment. We conducted the studies after this refinement.

4. Research in the Wild: Overview

We conducted two controlled in-the-wild studies to investigate whether visualization design or situatedness can influence passers-by to care more about women who were sexually harassed in a public space. We used a controlled in-the-wild approach to ensure ecological validity while preserving some of the rigour of lab experiments [CWSVM15]. Previous work identified small but significant differences in affect and prosociality while comparing on-screen visualizations with contrasting levels of information richness [MJAD21]. This work advances this knowledge by also exploring differences due to data representation approaches that differ in terms of physicality and situatedness, two design strategies that are still little explored in the context of Anthropographics [MJAD20].

All anonymized data, analysis code, and figures of this paper are available at `https://osf.io/sm9jx/`.

4.1. Public Spaces

We conducted the studies in Campina Grande, a 400,000-inhabitants city in Brazil (see Figure 3). For the first study, we exhibited the visualizations in two places that belong to a large central park: **Açude Velho**, a public lakeside where we collected data about

sexual harassment cases and **Parque da Criança**, a park adjacent to Açude Velho. People usually visit that region for doing outdoor activities such as practicing sports or relaxing. We controlled for situatedness since the visualizations were exhibited close to where the data refers to and people visit both Açude Velho and Parque da Criança to do the same activities [BKT*21]. For the second study, we explored situatedness by showing the same visualization in different regions: Açude Velho, where the harassment cases occurred, and **UFCG**, a university campus 5km away from the harassment incidents. Although the distance between Açude Velho and UFCG is not too big, we expected to affect situatedness since the places are in different regions of the city and have different visitors.

Figure 3: *`Parque da Criança` and `Açude Velho` constitute a central park where the visualizations were presented in the first study. `UFCG` is a university campus where a visualization was presented in the second study. Those regions (in orange and blue) are composed of distinct visitors who do different activities (i.e., study and leisure, respectively). Credits: Google Maps*

4.2. Measurements

We captured people's compassion towards the harassment victims. We consider compassion as *"the feeling that arises in witnessing another's suffering, and that motivates a subsequent desire to help"* [GKST10]. We follow the approach of previous work [KR05, VSMP14, MJAD21] by capturing both the affective and behavioral components of compassion.

Compassion's behavioral component (or prosocial behavior [BP03]) was measured by a donation task. The **intention to donate** is measured as the answer to the following quesiton:

> **Picture the following scenario**
> Suppose I give you R$ 100 for participating in this survey.
> If you wish, I can split this money between you and a donation to an institution that will promote a campaign to prevent harassment in the Açude Velho.
> *How much of the R$100 would you donate to the institution?*

The affective component of compassion was measured by a 5-point Likert scale based on Batson's empathic concern [Bat87], which was also used by Boy and colleagues [BPE*17]. The original English scale contains questions that ask "how much *X* they were feeling about the data they just saw", where the *X* corresponds to feeling *sympathetic*, *compassionate*, *moved*, *tender*, *warm*, and *softhearted*. Feeling levels range from "Not at all" to "Very". All the terms were translated to Portuguese by a professional translator, but participants reported they could not assess how much they felt *tender*, *warm*, and *softhearted* (translated to Portuguese as *carinhoso*, *caloroso*, and *generoso*). The reason is that there is no translation to Portuguese that reflects the original meaning of the terms. We thus only consider **self-reported compassion** as the median answer to how much *sympathetic*, *compassionate*, and *moved* participants felt at the end of the study.

5. Study 1: Exploring Information-richness and Physicality

This first study investigates whether the amount of information presented and the medium where data is represented affect people's compassion. We consider *information richness* as a combination of granularity (i.e., whether people are represented individually or as aggregated marks) and specificity (i.e., how distinctive the visualized people are from each other). Previous work [MJAD21] suggests that showing an on-screen information-rich visualization with human-shaped marks can produce a small but significant effect on affect and prosociality. In this work, we explore data representations with contrasting levels of information-richness. We also differentiated them in terms of physicality, which hypothetically affects compassion [MJAD20]. Our main goal is not to isolate the effects of each design strategy; instead we are interested in using the resources available to try to find a significant effect by studying a combination of design strategies. As far we we know, this is the first work that explores the role of physicality on compassion.

5.1. Stimuli

We tested three contrasting ways of presenting data about sexual harassment. The first stimulus consisted of talking to people about sexual harassment data without a visualization. We chose this stimulus because it is a common practice in activism approaching people on the street to inform them about social causes. The second stimulus is the Harassment Charts, a dashboard-like visualization printed out in a poster format that shows aggregated data about the harassment stories. Characteristics of the harassment cases (e.g., the harassment types, the time it occurred, etc.) were represented as different bar charts. We used bar charts because they are familiar data representations hypothesized as evoking less compassion or prosocial behavior than information-rich visualizations [MJAD20]. Finally, there is the Harassment Plants, a physicalization in which each harassment story is represented as an individual glyph that contains a great level of information – information-rich visualization. This visualization was designed to combine design strategies hypothesized to produce a large effect on compassion and prosociality compared to the Harassment Charts. Although those visualizations are different, we used identical text and design for the Charts and the Plants' legends to control the message variation. The visualizations are shown in Figure 4.

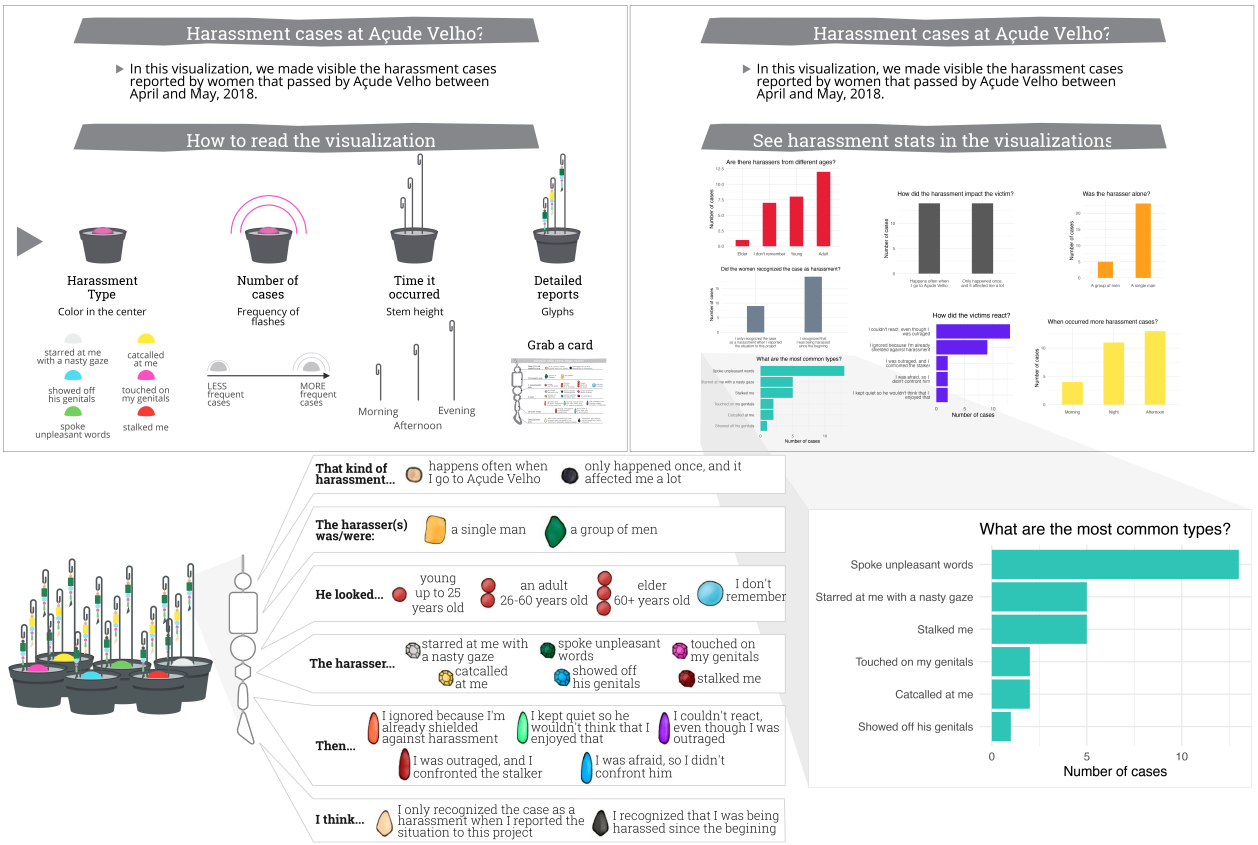

Figure 4: *Visualizations evaluated in the study (translated from Portuguese).* `Left` *– Harassment Plants and accompanying legends. Each pot contains reports of a different harassment type, which is redundantly represented as the color in the pot's middle. The stem's height represents the time of day: the smaller is morning, the taller is evening. Each bead that composes the glyph represents part of the harassment story, which can be interpreted by reading the card.* `Right` *– Harassment Charts. It contains a dashboard with statistics about the variables derived from the harassment reports. High-resolution images are available at* `https://osf.io/sm9jx/`.

5.2. Study Design

We examined how compassion varies when people see one of the three stimuli where the harassment incidents occurred. This study comprised three conditions: the **Baseline**, where we talked about harassment cases without a visualization at different spots of the central park; the **Plants**, where participants saw the Harassment Plants at Açude Velho; and the **Charts**, where participants saw the Harassment Charts at Parque da Criança. Although we showed the visualizations in different locations, we consider they were close enough in terms of situatedness [BKT*21].

5.3. Procedure

The study lasted one week and was carried out between 8 am and 6 pm during weekdays. The conditions required distinct set-ups, so we conducted them at different times of the day or locations. The Baseline did not require much preparation, so we did it when we arrived or close to when we would leave the central park. For the other conditions, two researchers conducted the study simultaneously at different places. We installed the Plants at Açude Velho, a crowded location, because the visualizations were hard to transport so we needed a higher flow of people. We exhibited the Charts at Parque da Criança, a less crowded place, because we could carry the poster to where people were gathered.

We used a similar approach to collect data in the Baseline and the other conditions. In the Baseline, we approached participants who were in the public place and asked them "did you know that sexual harassment cases occurred at the Açude Velho?". After their response, we disclosed overall numbers from the reports of sexual harassment in our data and presented participants with the questionnaire containing the donation question. In the conditions where we exhibited visualizations, we approached participants and asked "did you know that this visualization represents sexual harassment cases that happened in Açude Velho?". We also allowed interested passers-by to engage with the visualizations spontaneously. After participants' engagement with the visualization, we asked them to fill a questionnaire containing the donation question and Likert scales related to their levels of compassion.

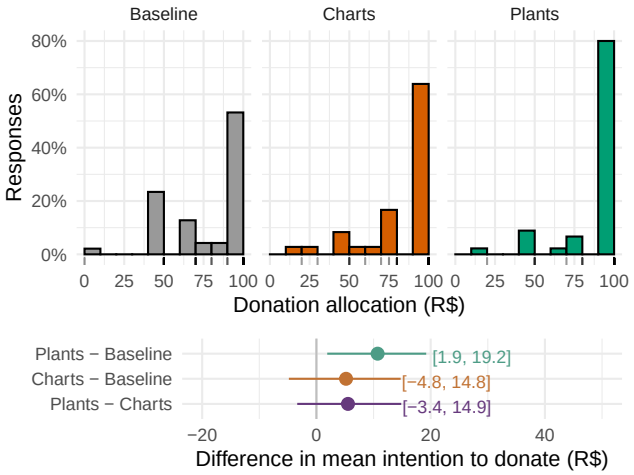

Figure 5: *Intention to donate in the first study.* `Top`*: responses to whom the data was presented verbally (Baseline), through aggregated charts (Charts), or through an information-rich physicalization (Plants); rugs on the bottom of each histogram show precise values.* `Bottom`*: mean difference between the three conditions; error bars represent 95% CIs.*

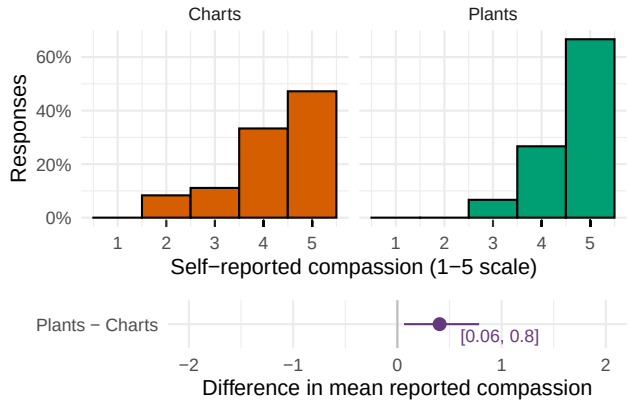

Figure 6: *Self-reported compassion in the first study.* `Top`*: responses of people who saw aggregated charts (Charts) or an information-rich physicalization (Plants).* `Bottom`*: difference in means between the two conditions; error bars represent 95% CIs.*

5.4. Participants

Overall, 128 persons participated in the study. Forty-five people participated in the Plants condition, 36 in the Charts condition, and 47 in the Baseline condition. Participants were walking, sitting, or eating close to the places where the visualizations were exhibited.

5.5. Analysis

We are interested in the mean difference between participants of different conditions for both intention to donate and self-reported compassion. We report these effects as point and interval estimates with 95% confidence intervals, and refrain from using the statistical null-hypothesis test framework. All confidence intervals are calculated through 5,000 bootstraps and biased-corrected.

5.6. Intention to Donate

The primary measure in our study is participant's intention to donate. Figure 5-top presents the distribution of this measure in the three conditions. The distribution is skewed towards high values for all three conditions but seems to be more concentrated on high values for the Plants. Figure 5-bottom shows the difference in mean intention to donate comparing the conditions pairwise. It is plausible that the Plants lead to higher donations compared to the Baseline, with either a considerable (up to R$19.2) or small (R$1.9) effect size. Comparing the Charts vs. Baseline and Plants vs. Charts scenarios does not allow us to conclude that there is a relevant effect in either case. In conjunction, these results point to a clear effect of indeterminate size of the information-rich physicalization in increasing compassion. At the same time, it may be that this effect is higher than that of a statistical chart, but we cannot rule out that both are equivalent.

5.7. Self-reported Compassion

Self-reported compassion was only measured for the Charts and Plants conditions, where participants engaged with a visualization. Figure 6-top presents the distribution of this measure for the two conditions. Respondents tended towards a high compassion, with a higher concentration on the maximum value in the Plants condition. Figure 6-bottom shows the point and interval estimate for the difference in mean compassion between participants exposed to the Plants and Charts. There is clear evidence of an effect of the Plants, leading to a higher level of compassion. Nevertheless, the range of plausible values for this effect admits only small to modest differences in the range of 0.06 to 0.8 on a 5-point scale.

5.8. Discussion

The results are in line with findings from previous work on anthropographics [MJAD21], which also found a mild difference between visualizations with different levels of information-richness. Even though we manipulated the visualizations' physicality to increase the effect size, we could not find a large effect. This finding brings more evidence to support the hypothesis that representing individuals with detailed information affects compassion in the same way or only slightly better than representing people using statistical charts [BPE*17, MJAD21]. However, it should be clear that all strategies tested in this study produced high levels of compassion.

The concentration of high values on both measurements might indicate a ceiling effect. This effect could be caused by a social desirability bias [Gri10] or because the experiment was conducted close to where the harassment cases happened. This result motivated a second study to investigate whether showing a visualization in a different context from where the events occurred would decrease people's compassion.

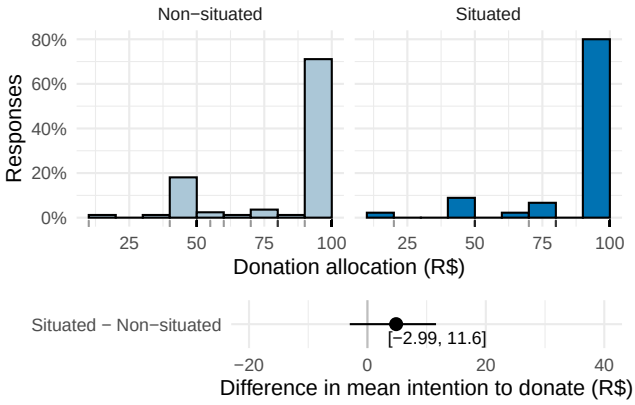

Figure 7: *Intention to donate in the second study.* `Top`*: responses of people who saw the Harassment Plants in the situated and non-situated conditions; rugs on the bottom of each histogram show precise values answered.* `Bottom`*: difference in means between the two conditions; error bars represent 95% CIs.*

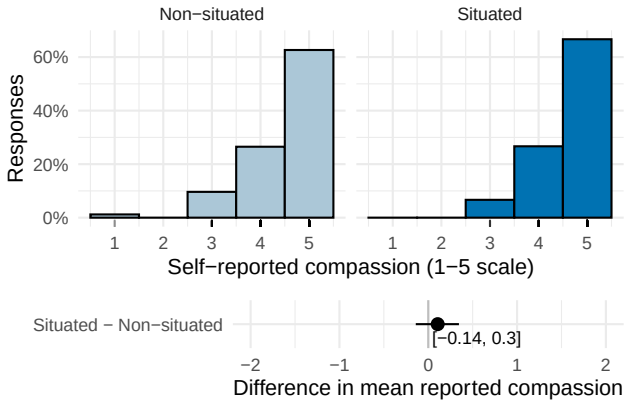

Figure 8: *Self-reported compassion in the first study.* `Top`*: responses of people who saw the Harassment Plants in the situated and non-situated conditions;* `Bottom`*: difference in means between the two conditions; error bars represent 95% CIs.*

6. Study 2: Investigating Situatedness

This second study examines the extent to which *situatedness* affects people's compassion. We explored this factor suspecting that the high compassion reported in the previous study could be caused by showing visualizations in a contextually relevant space. Besides, the effect of situatedness is still little explored in the context of Anthropographics [MJAD20]. To explore situatedness, we used the same information-rich visualization from the previous study. We presented the Harassment Plants in two different places that differ in terms of relevance to the data, both contextually and spatially.

6.1. Study Design

We tested the Harassment Plants in two conditions. In the **Situated** condition (the same as the Plants condition from the first study), people saw the visualization at Açude Velho, the place in the central park where the harassment cases occurred. In the **Non-situated** condition, participants saw the same visualization at UFCG, which is unrelated to the harassment cases and 5km far from where the incidents happened.

6.2. Materials and Methods

The data collection and analysis were the same as in the previous study. We reused the data from the Plants condition in first study, which now represents the Situated condition. We did so because it would be costly in terms of physical effort and time to collect data in Açude Velho again. To collect data for the Non-situated condition, we exhibited the visualization in two squares at UFCG. We collected data for the Non-situated condition one week after the first study, during a whole day.

Overall, 128 persons participated in the second study. Forty-five people engaged with the Plants in the Situated condition (we used the same data from the Plants condition), and 83 people saw the visualization in the Non-situated condition.

6.3. Intention to Donate

Figure 7-top shows that the distribution of intentions to donate is similar in both conditions: most respondents expressed the intention to donate all or almost all of the money to help preventing harassment cases in Açude Velho. Similarly, Figure 7-bottom suggests no clear evidence that the intention to donate between situated and non-situated conditions differs. Our findings suggest that it is unlikely that a situated version of the Harassment Plants evokes more compassion than a non-situated one.

6.3.1. Self-reported Compassion

The visualization situatedness also did not seem to affect the self-reported compassion of participants. Figure 8-top shows that the distribution of responses between situated and non-situated conditions follow the same trend, with most responses ranging from 3-5. Consequently, Figure 8-bottom suggests no difference in means between the two conditions. Therefore, it is likely that people felt the same when they saw the Plants, independent of situatedness.

6.4. Discussion

Our findings suggest that using a situated physicalization about a sensitive topic seems to evoke the same level of compassion as a non-situated version. Although this is an important contribution, the result must be interpreted with caution. This study addressed a sensitive topic (i.e. sexual harassment), which might influence the compassion of people independently of the context where they saw the visualization. Also, there might be differences between the samples of the university campus — where people tend to have spent more years in education — and the central park. Therefore, situatedness should also be explored in more controlled scenarios and with other topics to assure the generalizability of our findings.

7. Experience with Research in the Wild

This work sheds light on the challenges of conducting research in the wild. We discuss the observations and decisions made during our studies. We do not aim to generalize our findings but present our experience to help other researchers plan their in-the-wild studies.

7.1. Dealing with Design Constraints

Deploying a physicalization in the wild is challenging. While designing the Plants, for example, we had to consider materials that are resistant to water and wind because of the weather, an easy structure to disassemble for transport, and how to avoid vandalism. In the end, installing the physicalization became a demanding task since it weighed approximately 25kg, and the glyphs should be detached from the pots to be transported during every new exhibition. Those constraints affected the plans for our studies.

The limitation of transporting the Plants forced us to come up with study designs in which we would move the physicalization as little as possible. We initially planned to present all stimuli in different parts of the central park to fully control for situatedness, but when deploying the Plants for the study, we decided to install them only once a day in Açude Velho, which has a higher flow compared to Parque da Criança. We tested different areas in Açude Velho until finding one with a consistently high flow of people. For the second study, we decided to reuse part of the data from the first study to avoid deploying the physicalization again in Açude Velho. Those decisions were deliberately made to balance the trade-off between the study robustness and the effort to carry it out.

7.2. Exploring Engagement

While conducting the study in the wild, we explored why people engaged with the visualizations and adapted our data collection accordingly. We initially planned to only talk to participants at the end of their interaction with the visualizations, to collect their data. But we quickly realized that several passers-by just ignored the visualizations. So we decided to ask some of them why they did not stop. The answers revolved around being busy (e.g., they were late for a meeting, practicing sports, doing picnics, etc.) or not knowing what the visualizations were about, especially the Plants. Some people thought, for example, that the Plants were part of the decoration or crafts for sale. That latter motive made us promptly change the data collection procedure to the one described in subsection 5.3.

We changed the data collection strategy to approach people who were passing by the visualizations instead of waiting for their engagement. In doing so, we increased the number of people who participated in the study, but also attracted some participants with little motivation to participate. The unmotivated participants mentioned that they were not interested in spending much time interacting with the visualization or answering the questionnaire. Some of them did not complete the compassion scales or did not explore the Harassment Plant's legends. Therefore, getting more participants might have had a cost.

We also observed a phenomenon that seems to have increased the engagement of passers-by. When one or more people stopped to interact with a visualization, it seemed that other people would become more motivated to engage with that too. While it helped us collect data, it caused situations where people were talking to each other while answering the questionnaire. In that case, the researcher had to intervene and ask them to fill out their questionnaires away from each other. We tried to avoid such situations by clarifying to each participant that they could not share answers.

8. General Discussion

We now turn to the implications of our findings.

8.1. Do Visualizations Promote Compassion?

We hypothesized that presenting an information-rich physicalization would motivate people to donate more for fighting harassment than showing aggregated bar charts in a poster. However, we could not find evidence of a clear effect to support this hypothesis. Those results are in line with previous work [BPE*17, MJAD21] that either did not find evidence or only found a small effect when compared visualizations with contrasting levels of information-richness. If we assume the effect of information-richness is small but significant, as suggests previous work [MJAD21], using this kind of data representation in donation campaigns could bring relevant benefits to organizations. Replacing conventional charts with information-rich visualizations does not demand much effort, and if the number of donors is large enough, the small increment could sum up to a considerable amount.

This is the first work that found evidence that presenting an information-rich visualization in a public space seems to motivate people to donate more when compared to just mentioning the data orally. Also, we discovered that the reported compassion of participants and their intention to donate does not seem to change according to the contextual relevance of the place where the visualization is shown. If those findings are true, it reinforces the strategy of deploying information-rich visualizations in campaigns. Nevertheless, such strategy could only succeed if the effect of those anthropographics on donations is large enough. Further studies could contribute to understand how large this effect is and what individual strategies are more effective.

Until now, the literature of Anthropographics was not able to find evidence that using different anthropographic designs can drastically affect prosociality. However, there is also the risk that the measurement procedure may need improvement to detect such an effect. In our context, it seems that there was a ceiling effect in intention to donate probably due to a social desirability bias [Gri10]. Although we created our measurement based on procedures established by previous work [Bat87, BPE*17], it is possible that a context where answers vary more allows one to observe difference in compassion. Another possibility would be that real money allocation produces different answers than hypothetical money such as the one in our experiment. Future work should address these issues using real money or other tasks requiring a certain level of prosociality and effort. Such tasks could involve spending some time filling out a petition to help women in need, asking participants or to spend time distributing flyers against harassment, for example. Those measurements may provide more reliable and ecologically valid responses since they simulate real civic engagement actions.

8.2. Evoking Emotions vs. Provoking Action

We confirmed the assumption that people perceive them as more concerned after observing the information-rich visualization instead of the aggregated chart. Our results concerning emotional response are in line with Morais et al. [MJAD21], which found that people expressed more negative feelings when they saw information-rich visualizations representing people through individual marks. However, findings from both studies suggest a small effect, contrary to practitioners' expectations that some of the employed designs would touch the readers considerably [Har15, Ros16, MJAD20].

According to the results of prosociality from this and previous work [MJAD21], we suspect that information-rich visualizations might touch people while failing to motivate them to donate more compared to basic charts. If this is the case, that design strategy might not be effective according to a utilitarian point of view. Although showing detailed information about each person would evoke feelings, this strategy would not motivate readers to help relieve the suffering of the persons represented. On the other hand, we still do not know much about other design strategies [MJAD20] or whether anthropographics affect other prosocial behaviors such as volunteering, or different aspects such as engagement or memorability.

8.3. Benefits and Challenges of Research in the Wild

This work contributes to discussing the benefits and challenges of researching data visualization in the wild. Exploring visualizations in the wild allowed us to capture unexpected behaviors and get genuine feedback from participants.

We explored people's flows and engagement with visualizations in the wild. We identified that attracting one or more people to interact with visualizations in a crowded area can generate the honeypot effect [BR03], which is when people get interested in exploring the artifact because others are already engaged. We also discovered that some people did not engage with the visualizations in the first place because they did not understand them. An effective strategy to overcome that problem was inviting passers-by to participate in the study. However, recruiting unmotivated participants might have increased the number of incomplete responses. Thus, attracting more participants seems to have a trade-off between getting more data at the cost of having less accurate or incomplete answers.

Another drawback of dealing with several participants at the same time is the influence of one to another. When there was a high flow of participants interacting with the visualization and answering the questionnaire, it was hard for the researcher to ensure that participants would not share their responses. Controlled research in the wild requires thorough strategies to deal with this challenge. Solutions for increasing participants' commitment could be paying or inviting them in advance. The latter solution would allow participants access to the research protocol before the study and have enough time to participate alone. Another way to increase control is to have more researchers in place. Alternatively, researchers could evaluate situated and physical visualizations through more controlled approaches, such as using virtual reality to emulate a situated context [WAV*20].

8.4. Limitations

Although we conducted controlled research in the wild, our work has some limitations.

First, there is a considerable difference between the design of the Plants and the Charts, so we cannot separate the individual effects that played a role on our findings. Nevertheless, we clarify that this was a deliberate choice since our aim was having considerable differences between the stimuli in order to increase the likelihood of finding a large effect size.

Second, due to the difficulty of moving the physicalization during every new exhibition, we decided to show the Plants and Charts in different locations in the first study. Situatedness could be considered as a confounding factor in the first study, but there are two counterarguments for that. One reason is that the visualizations were exhibited in adjacent places that shared the same public. The other argument is that our findings do not support the hypothesis that situatedness plays a major role on compassion.

9. Conclusion

This paper presents results from two in-the-wild studies that explored the effect of visualizations on compassion. Our findings suggest that displaying a physicalization with detailed information about people seems to motivate participants to donate more when compared to only describing the data verbally. We also found that participants expressed the intention to donate all or almost all the money, independently of where the physicalization was presented. This evidence suggests that showing an information-rich visualization instead of presenting the information without a visualization can be a way of increasing donations.

Results also imply that presenting different visualization designs might not affect people to donate differently. It is not clear from our data whether using an aggregated bar chart to represent the same data is as effective as showing an information-rich physicalization to motivate donations. Nevertheless, we found a significant difference in the reported compassion that the two data representations evoke. A more controlled study and a larger sample size could help obtain more precise results in future work about prosociality.

Besides the main findings, this work also advances the research and practice of data visualizations. First, it discusses the strengths and weaknesses of researching visualizations in the wild. Second, it describes the process of designing and installing a situated physicalization in a public space. Those contributions present an alternative to research outside the lab and help understand the physicalization design process.

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