VisuaLife: A Campaign Aiming to Visualise Air Pollution in the Form of T-shirts Displayed in an Exhibition

Abstract

Every day thousands of Londoners are being exposed to dangerous levels of air pollution, with an estimated 9,500 of Londoners dying prematurely as a result. However, the urgency of this issue is often neglected due to the invisibility of pollutants among us. In order to support environmental organisations such as Greenpeace Camden, a push towards the increase of public awareness is essential when tackling air pollution. We present VisuaLife, an engaging campaign which aims to visualise air pollution in the form of t-shirts displayed in an exhibition. The exhibition will act as a platform for discussion among all residents and empower Greenpeace Camden to call for environment-friendly changes among politicians and industry leaders.

Author Keywords
air pollution; visualisation; public campaign; public engagement; environmental issues;

ACM Classification Keywords
H.5.2 User Interfaces (D.2.2, H.1.2, I.3.6): User-centered design. H.5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous.
Introduction

For the seventh time in 13 months London’s mayor, Sadiq Khan triggered a public emergency as the polluted air above London reaches dangerous levels. According to research undertaken by the Greater London Authority and TfL in 2017, the concentrations of PM$_{2.5}$—a mixture of solid and liquid particles with a diameter of 2.5 micrometers or less in the air—in London exceeded the WHO guideline limit of in 2013 [7] and a study released by King’s College London indicated that an estimated 9,500 of Londoners are dying prematurely every year as a direct result of air pollution [2]. Such critical issue calls for more attention from the government and local communities around London with support from environmental organisations to create a voice for change.

Among all the environmental organisations, Greenpeace Camden is a community of environmentalists who is dedicated to protecting the Earth through political lobbying and citizen action. Our initial research with Greenpeace members shows that one of the main challenges for Greenpeace is revolving around “raising public awareness”. Also, we found that their traditional forms of campaigning when addressing global issues are less effective in raising local attention for air pollution. This finding is backed up by our online survey for the general public. Our survey demonstrates that less than half were “fairly informed” of the environmental issues and 56.69% of the respondents think Greenpeace only has a moderate amount of impact on environmental issues.

Given these issues, we propose VisuaLife, an innovative approach for illustrating air pollution through daily objects—T-shirts. We address the common notion of ‘seeing is believing’, a statement which is not the case with air pollution, as it’s neither visible nor tangible, therefore the importance is often neglected. By visualising air pollution with the engagement of local residents, we embody Greenpeace Camden’s’ mission - ‘transforming the world by changing the way people think about it’ [8].

Research and establishing requirements

After choosing Greenpeace Camden as our target community, we delved into understanding different environmental issues promoted by Greenpeace. We conducted in-depth semi-structured interviews with three members of Greenpeace (two staff working as a coordinator and a campaigner and one volunteer). The questions of interviews are based on the literature review about challenges in non-profit organisations in terms of fundraising, human resources, organisation and publicity [3][4]. Each interview was structured in three parts: 1. experience in Greenpeace 2. the operations of Greenpeace 3. opinions on the challenges mentioned above. In addition, we used an online survey comprised of open and closed questions to uncover public attitude towards environmental issues, non-profit organisations, and Greenpeace. At the end, 51 responses were collected with age ranging from 18 to 34 years old.

In order to organise our data and subsequently define the most common themes, we created an affinity diagram (Figure 1) to identify the main challenges. After careful examination of the transcribed interviews, the most common themes that we came across were:

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Our thematic analysis of interviews offered insights into establishing requirements, which then was implemented within our own concepts. The reoccurring theme that was highlighted across all interviewed members was “raising public awareness for environmental issues” while most of the campaigns organised by Greenpeace are on a more global scale without localisation strategy to encourage local involvement of the general public. Furthermore, an important finding is that Greenpeace uses more traditional ways to raise awareness such as setting stalls on the street and online petitions through emails which do not gain a lot attention due to the lack of public engagement. On a related note, less than half of the respondents from our online survey were “fairly informed” of the environmental issues. Regarding the most effective way of tackling these issues, 37% of the respondents chose “providing more information to the general public” while 32% of the respondents chose “stricter environmental legislation”. Moreover, 56.7% of the respondents think Greenpeace only has a moderate amount of impact.

Among all the environmental issues, the interviewees pointed out that the biggest environmental threat to London citizens is air pollution, which Greenpeace have already carried out a number of campaigns related to this issue. Greenpeace’s concern about air pollution is backed by a vast number of reports and experts [6].

To sum up, our conclusion is that the general public is not well informed of the activity of Greenpeace and the traditional forms of campaigning global issues are less effective on raising public awareness. We aim to empower the community of Greenpeace Camden and to support their interaction with the general public in working towards the common goal of tackling air pollution.

From our findings we established the core requirements for our product:

- Must provide an effective means of communication between Greenpeace Camden and the general public (people living in the borough of Camden)
- Must help Greenpeace Camden to raise awareness about air pollution
- Should encourage change of behaviour
- Present the issues in an innovative way
- Introducing the issue locally

**Initial ideas and user feedback**

Based on the findings of our research, we analysed various stages of design utilising the diverge-converge pattern to ideate our prototype. In the first stage of divergence, we used a concept map to illustrate our initial brainstorming of various aspects of air pollution, such as the images of air pollution, context, level of awareness and health issues. Additionally, we examined different aspects of engagement in order to understand people’s expectation and incentives for engagement. In the second stage of convergence, we combined ideas together and focused on the idea of “physical visualisation of air pollution”.

**Figure 2**: an early sketch of different ideas

**Figure 3**: an early sketch of different ideas

**Figure 4**: an early sketch of different ideas
In the following stage, our team explored existing designs of visualizing air pollution as well as innovative ways of data visualisation as inspiration. After several rounds of discussion, we explored a variety of innovative options. At the end of this stage, we started sketching three preliminary ideas:

1) A t-shirt which changes colour when exposed to air pollution (Figure 2)

2) An installation which illustrates the effect that air pollution has on our lungs with Individual carbon emissions calculator (Figure 3)

3) An installation which demonstrates the contrast between the natural environment and the polluted city (Figure 4)

After using personas to examine these ideas, we decided put forward the first idea and further developed it into "T-shirts which change colour when exposed to air pollution and then be displayed in an exhibition".

As part of the evaluation of the concept, we used a storyboard (Figure 5) representing our initial concept to conduct interviews with two Greenpeace staffs. The majority of feedback was positive, but Greenpeace members offered some suggestions such as “ensuring the dye will stain properly” and “ensuring users will go through a key route where pollution is known to be significant”. Meanwhile, we conducted research to find out whether there are any chemical reactions which causes dyes in the shirt to change colour, when exposed to air pollution. We soon realised that it was impossible to implement such chemical reaction on a T-shirt. Therefore, we came to the solution of attaching an air pollution sensor to the T-shirt that collects air pollution data. As inspired by MIT lab [3], we decided to use ink produced entirely out of air pollution and spray different amount of ink on the T-shirt, according to the different pollution levels taken from the sensor. We soon discovered that this method was a powerful way to visualise air pollution. Moreover, an assessment of the concept led to further refinement of our idea. Based on the feedback received we decided to attach a tag showing user’s daily journey to the T-shirt in the exhibition as to give the audience richer information.

In the end, we refined the whole concept into a campaign called "VisuaLife" which aims to visualise London’s air pollution in the form of a T-shirt.

**Final Outcome**

Our final outcome, VisuaLife, is a campaign aiming to evoke awareness of air pollution by depicting the amount of air pollution that we face in our daily routine in the form of T-shirts (Figure 6,7,8). At first, plain white T-shirts will be distributed among Greenpeace members and volunteers from Camden. Participants will wear the T-shirt for one day, ensuring they are going about their daily activities uninterrupted.

A GPS and an air pollution monitor will be attached to each t-shirt to help us collect data from the participants. The monitor uses a laser detection sensor to measure the real-time level of Particulate Matter 2.5 (PM$_{2.5}$)— particles with an aerodynamic diameter less than 2.5 µm—which can lead to respiratory and cardiovascular diseases in long term exposure [2]. The GPS tracker will record participant’s route. Thus, we will have an accurate reading of how much pollution...
participants are being exposed to with the changes of their locations throughout the day.

After collecting the t-shirts at the end of the day, ink will be sprayed on the tops to visualise the level of pollution participants are being exposed too. The amount of ink used will be in proportion to the 24 hours mean density of PM$_{2.5}$ ($\mu$g/m$^3$) taken from the monitor (Figure 9) - the higher the value, the more ink will be applied on the t-shirt. Moreover, the ink we use is AIR-INK invented by MIT Media Lab. AIR-INK is purified carbon-rich pigment made from vehicle emissions. This approach presents an organic and artistic expression by using recycled polluted air to add depth to the concept, as well as supporting Greenpeace in shifting towards a greener and sustainable environment.

Once sprayed, each t-shirt will be attached with a tag showing the participant’s daily route along with highlighted areas which reveals the most polluted sections of the route, which will then be displayed in an exhibition within Camden. The public exhibition promotes open dialogue, encouraging all members from Camden to engage with each other, challenging conventional ways of approaching the public. By illustrating air pollution, these t-shirts encourage the audience’s awareness of the issue and opens a platform for environment-friendly changes, such as reducing the use of polluting vehicles. This degree of empowerment ensures our campaign follows the mission of Greenpeace - transforming the world by changing the way people think about it.

Furthermore, the public exhibition encourages media coverage which, in return, promotes a wider level of engagement, a chance to voice the community’s concerns and to challenge and change the behaviour of local government representatives and industry leaders to hear and reflect on these concerns surrounding the results of the exhibition.

VisuaLife is a reflective campaign for both participants and the residents of Camden, visualising air pollution before it becomes visible within ourselves.

**Discussion**

Many reports indicate that Londoners suffer from illegal levels of pollution. Following the analysis of data collected from the Greenpeace Camden community and the public survey, our team came to the conclusion that making the public aware to actions and campaigns undertaken by Greenpeace could be a great solution to empower and support the community. By spraying t-shirts with ink derived from air pollution, VisuaLife provides a way to turn air pollution into a visible and tangible thing. Additionally, showing the results of the campaign in a local exhibition will not only increase public awareness but also engage the general public with Greenpeace.

Although the majority of the feedback from Greenpeace members on VisuaLife were positive, an evaluation survey about our final prototype gave us a deeper understanding of the current limitations and how the idea could be refined in the future. After completing the physical prototype, we collected feedback from Greenpeace members both in the form of face to face interviews and of questionnaires. In addition to the qualitative data provided by the interviews, the questionnaire was filled out by 14 members. Seventy-
five percent of them strongly agreed with the idea that VisuaLife matched Greenpeace’s mission of raising public’s awareness and reflecting air pollution level through physical visualisation.

Regarding the limitations, data suggested that the impact of VisuaLife on the public could be reinforced by adding additional information about the negative effects of air pollution with the purpose of education and evoking changes in the public's behaviour. Moreover, a social media element such as a hashtag could be directly integrated on the t-shirts while exhibited to ensure a wider audience could be reached, therefore opening up our campaign internationally.

Even though VisuaLife promotes itself as a local campaign, the idea could be scaled up to include all boroughs of London. Each borough can benefit from their own exhibitions through the power of engagement. Opening up the campaign to all, will allow each community of London to compare results with each other, understanding who and why some boroughs are more polluted than others. This starts a new wave of conversation, not only with different communities but with local representatives, allowing residents to demand why their community is more polluted than others.

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References