Projection Mapping in the City: Co-creating Public Digital Installations for Climate Awareness with Animation and Interaction Design Undergraduates

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We report from a project where students created animated public content to promote the urgency of climate change and encourage positive behavior change amongst a city's citizens and stakeholders. We worked with [anon City] Council whose Net Zero agenda has been formulated to mitigate and adapt to climate change, including by changing public perception and promoting more sustainable lifestyles. 32 final-year Animation and Interaction Design (IxD) undergraduate students worked in a collaborative design process to create seven site-specific public campaigns applying animation and projection mapping technologies. Educational challenges included working with new technology, delivering a professional quality result to an external client, and a short 8-week schedule. The results included an interactive game to engage publics in the concept of plastic bottle deposit recycling scheme; 'guerilla' projecting on a major clothing retail store intended to encourage passing shoppers to reflect on their role on the negative aspects of fast fashion; and an installation across some of the underground metro stations to highlight and celebrate the sustainability principles of public transport. Our contribution includes our case study of an agile structured collaboration process, with the dual focus of creating high-quality, engaging and site-specific creative content and promoting a specific aspect of the Council's policy agenda. Additionally, we discuss insights into tailoring projection mapping and animated content for civic communications purposes and encouraging digital animation students – who typically work on their independent production – to engage in collaborative processes and civic responsibilities.

CCS CONCEPTS •Human-centered computing~Interaction design~Interaction design process and methods •Applied computing~Arts and humanities~Media arts •Computing methodologies~Computer graphics~Animation •Computing methodologies~Computer graphics~Graphics systems and interfaces~Mixed / augmented reality

Additional Keywords and Phrases: Projection Mapping, Site-specific Animation, Civic Collaboration, Net Zero.

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1 INTRODUCTION

Computer animation has the potential to create highly engaging content that reaches and has the potential to impact on the everyday understandings and behaviors of a wide range of people. Computer games, animated shorts and feature films from Pixar and elsewhere are on par with live-action content in their immediacy and emotional affect. Presented in public settings, such creative content can reach and meaningfully engage wide publics, communicating a persuasive message

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towards promoting understandings and changed behaviors. *Projection mapping* is one popular technique that is used across a range of domains, including marketing, to create engaging interactive displays by mapping computer-generated content onto 3D surfaces.

In this paper we share our reflections and outcomes of designing and running a student brief that utilized projection mapping to promote understanding around *Net Zero* in [anon city]. The authors ran the eight week module from January to March 2022, having being approached by the Council's Net Zero team to help them address the public information aspects of their challenge of achieving Net Zero emissions by 2030, 20 years ahead of the national target. Clearly, achieving the feat of Net Zero requires immediate yet far-reaching step-change and the Council recognize that this is only achievable by first informing [the city's] citizens and stakeholders of their plans and, importantly, bringing everyone together to collectively reduce the city's carbon footprint and mitigate and adapt to the effects of climate change. The Council was particularly interested in using projection mapping as a way to communicate their agenda due their involvement in a Design School module the previous year.

Collectively the authors and the Net Zero team lead set the brief for 32 third-year Animation and Interaction Design undergraduate students. The students then worked in groups of seven to collectively research, propose and implement in the form of proposals (video/experience prototype and technical plan) their ideas, focusing in on communicating one key specific aspect of the wider Net Zero agenda at a relevant public site in [the city].

In this paper we first give a short background to projection mapping technologies and then introduce the Net Zero brief and the teaching approach we took to achieve our aims. We highlight student outcomes and some of the Council's comments following review. Finally, we share lessons learned, including how to efficiently develop computer animation content for public installations within creative and collaborative undergraduate programmes.

2 PROJECTION MAPPING

Unlike large computer graphics displays, such as *CAVE*s, which place the user inside a fully rendered virtual world [6], projection mapping is versatile in being adaptable to specific indoor or outdoor settings,[1] and can enable highly impressive graphics that integrate with their physical environment, creating a shared experience. Popular examples include vast colorful animated sails superimposed on the Sydney Opera House [10], and transforming St Andrew Square in Edinburgh into a magical night garden [4]. Projection mapping thus has wide applicability to experiential design and has spawned a number of specialist companies that offer services to generate and install content along with those that have developed dedicated software and hardware tools, including *MadMapper*[2] and *Lightform*,[3] making the production of installations more available to different groups, including university students.

3 THE BRIEF

The authors had previously worked with the Council and Interaction Design university students to create interactive installations. One earlier outcome was a concept for a large-scale projection mapping project on the central train station building to inform the public about the Glasgow Climate Summit. Impressed with the potential, the Council proposed a follow-on project using this technique exclusively. We decided to carry this out in a module which was composed of a mix of Animation and Interaction Design third-year undergraduate student. We expected this mix of students would be particularly fruitful as projection mapping requires both high-quality animated content as well as situating it in a public

[1] https://projection-mapping.org
[2] https://madmapper.com
[3] https://lightform.com (discontinued)

setting, with regards given to the audience and potential interaction. The authors and the Council collaboratively composed a final brief, which stated:

Your task is to design a projection mapping installation that supports the City's Net Zero vision and contributes to making it not be a net contributor to climate change by 2030. The service should do this by promoting, supporting or creating positive behaviors, business models or other changes that contribute to the vision, e.g. by:

- *Encouraging use of low emission transport such as bicycles rather than cars*
- *Creating new consumer patterns that are carbon neutral*
- *Limiting the use of energy to transport goods, etc.*

The mapping should be designed to be shown at a particular location *or building, e.g.*

- *The Riverside*
- *The City's Main street*
- *A local high street or business district, etc.*

As time did not permit to implement the projections in situ, the groups were asked to each produce a 2-5 min concept video prototype to show to the Council. This would be complemented with a detailed design document to explain installation requirements, budget and time plan.

4 CHALLENGES

The challenges in this project included:

- *Working with new technology:* None of the students had previous experience of projection mapping.
- *Delivering to an external client:* The students had to present their work as if it was a real professional project.
- *Compressed schedule:* The students had to go from brief to final presentation in just 8 weeks.
- *Working in groups:* The IxD undergrads had previously worked in a similar group project, but the Animation students had never worked in groups, and were only used to creating and delivering completely by themselves.

5 PROCESS

To meet these challenges, we created a compressed design process comprised of four phases of 2 weeks each, totaling 8 weeks for the whole project. As the time was very short, it was essential to follow the process closely and ensure students delivered by having frequent checkpoints and presentations. To ensure the concepts were realistic and relevant, we included requirements to do in-situ studies of the locations and potential audience before settling on a concept.

Discover Phase (weeks 1&2) – We began by closely reading the brief and the Council Action Plan [2] calling for impactful urgent action by key stakeholders. We then examined other creative and site-specific public campaigns, finding communication design for public health especially useful e.g. [7]. Such messaging grabs target publics' attention and promotes behavior change through the combined use of visual language, tailored for the target public, and appropriateness of physical site. Elsewhere advertisements on transport systems can raise travelers' awareness of the dangers of transmittable diseases [7]. Such warnings however quickly become familiar and less effective, over time, in grabbing attention (see Figure 1). Further design inspiration came from recent site-specific interventions: for example, during the COVID19-related lockdowns simple designed solutions included apps to order food from the outdoor table enabling the hospitality sector and dining publics to return to some normality; *clap for carers* was a physically-distanced neighborly

experience shared every Thursday at 8pm across the UK, [5] while 'pop-up' cycle lanes enabled safe essential journeys *and* exercise. A further seminar focused on linking these solution-based approaches to the creative possibilities and the practical technicalities of projection mapping. Then, in assigned groups students researched, conducted site visits and ideated early designs, before deciding on one core problem as set out in the Action Plan and an appropriate site, considering reaching (or creating) their target public and practical installation (e.g. light levels).

Figure 1 From left: a driver failed who failed to heed warning signage; RAG food indicators in the bottom left of the pizza box; recycling bins communicate purpose visually; online weather forecasts with visualized likelihood of conditions.

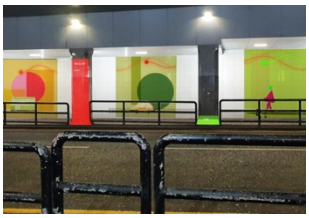
Define Phase (weeks 3&4) – In this phase, the students were required to define their concept in detail and situate it in their chosen location. We stressed the importance of doing real-world research at the respective chosen locations. This included small ethnographic studies and questionnaires to understand the different visitors at the sites; documenting the site's appearance during different times of day through sketching and photographs; and doing observations in order to understand the flow of people and visibility of the location. Although the time was short, this research proved essential for situating the concepts in the city and paid off in the final presentation, as the client could see how the different concepts were relevant for the chosen audiences and locations.

Develop Phase (weeks 5&6) – With sites researched and concepts defined, the students then worked to create their videos, and also to flesh out the practical aspects. The main work during this module consisted of creating the animation elements for the installation and incorporating them in the footage from the sites. Furthermore, although they would not be able to install the projection mapping in the real sites, we required that they did a full budget as well as research all practical aspects for installing and maintaining the installation, and a detailed time plan.

Deliver Phase (weeks 7&8) – In the final two weeks the students finished their videos and did presentations. We stressed the importance of stand-alone, self-explanatory videos, complemented by a more detailed presentation deck and design document. The students did test presentations in week 7 to get feedback, and finally presented their finished concepts and videos to the client in week 8. The City Council was represented by their Net Zero lead, meaning that the feedback was highly relevant and directly related to the original brief set by the council.

6 OUTCOMES

The process worked, and all student groups delivered high-quality work and presented them to the client. The specific outcomes were:



Project 1: Road to Net Zero A main city thoroughfare for hundreds of buses is transformed from a largely neglected underpass to a cheerful dynamic gallery space through animation, seen by both those awaiting buses and those travelling on them. The animation used primary colours, semi-abstract shapes and fluid motions in a "cool vibe". The client became quite excited as the area is about to receive major investment and this concept presented previously unimagined, novel possibilities.

Project 2: Against the Trends This provocative message aimed to promote awareness and personal reflection of passers-by on the City's busiest shopping street. The visuals presented animated characters as though taking selfies in new outfits to post to Instagram. Periodically, clothes fell into a pile, referencing how "fast fashion" and especially its over-consumption contributed substantially to landfill. The characters captured diversity of body type, etc. The call for reflection was extended through the proposed hashtag #AgainstTheTrends

Project 3: Eat Fresh Waste Less This piece that told a story supported by facts and statistics about reducing food waste, presented across different locations around the City's indoor market. Fun aspects of the stylization included flying fruit and vegetables across the market's ceiling. The concept also included infomercials to help explain and offer very practical advice around composting, saving money etc. as a call to action. QR codes linked to an accompanying website that included more substantial information including recipes, and linked to social media to help build a community. This was one of the client's favourites, partly as it helped promote local food stalls led by sole-traders!

Project 4: Choose Green, Choose Metro This concept video walks the viewer through a Metro [underground] journey giving a sense of the whole user experience and demonstrating how the sited animations update in real time, driven by user data (e.g. swiped cards/tickets) and giving a nice sense of time and motion and positive climate impact. The graphics, clear and self-explanatory, really promoted how public transport contributes to the City's ambitious Net Zero agenda, with the soundtrack having a sense of urgency and a final "doom" scenario calling for action. This project included a fully functioning website adding to the reach and longevity of the project. The animations were very well embedded into the additional video and textual visuals, giving the sense that this was not a mock up simulation, but the real thing at a professional pitch.

Project 5: Net Zero [City name] This historical castle location was a good choice as it was itself a victim of urban planning years ago when the city authorities ran a major road through, rather than round, the site. While the client questions the subsequent footfall the team had rationalised that this was a landmark with high visibility from across the City. The concept was presented as an art installation where glowing liquid poured into the castle depending on the amount of passing traffic and lowered in response to more pedestrians. The client really liked the idea that the liquid would glow golden at night. There was also succession of weekly events to keep interest over time.

Project 6: Hey [City name] This concept used infographics projected onto the law court buildings adjacent to a busy public space to promote plastic bottle recycling through a deposit scheme – as is widely used in other parts of Europe. An accompanying interactive experience involving jumping on discarded plastic bottle to turn them into golden coins was very well demonstrated and simulated in the video. We liked the water- and plastic-related animations a lot and it was fun to see how the text interacted with the visuals. The

Hey [City's name] slogan was imaginative and overall, a coherent concept that could really work well as a public experience drawing people to the location while promoting Net Zero action, and the client agreed that bottle recycling was something that should definitely be on the future agenda.

Project 7: Road to the Future This concept used a historical landmark bridge innovatively almost using the bridge as a 3-D screen to present different styles of animation that synthesised well visually. A historical angle looked at the changing modes of mobility and their effects on the environment – suggesting that by looking back we will begin to better understand how to envision a different and better future.

7 RESULTS AND FEEDBACK

Despite the challenges, including the short time frame, the demands of an external client and the fact that the students had no previous experience of projection mapping, all groups managed to produce fully finished concept videos that integrated well with their chosen location and told a compelling story around the City's Net Zero ambitions. By working under a tight time schedule with clear phases, we were able to guide the students from the original brief to producing a complete concept video in just 8 weeks. The fact that they were working to a real brief with demands on practical aspects such as budget and time plan helped sharpen the students' focus, as well as the fact that they would be presenting to an important representative from the client side. For the Animation students who were not used to group work this was an important experience and they often found "roles" within the group, such as project manager, content creator, video editor, etc.

For the client side, they agreed that they got very inspiring ideas from the students' work. The work at a City Council can be limited in ideas and creativity, and by getting a wide variety of ideas they thought they would be able to shake up their approach to public information presentation in the organization. The access to finished video prototypes was particularly useful as it helped to visualize the ideas and communicate them in a way a text description or images could not. The client said that "Now I can take these videos to show to my colleagues and inspire them to think in a completely different way" about public information presentation.

8 CONCLUSION

With this project, we engaged a group of students with no previous experience in either projection mapping or producing content for civic engagement, and guided them to produce a finished concept in just 8 weeks, with highly positive feedback from the external client. The students worked in groups drawing on their expertise as animators and interaction designers, but also had to become project leaders, policy researchers and public installation planners in order to solve the task within the time and practical constraints. Both we and the City Council believe this shows how we can engage digital media students – and soon to be professionals – in the service of public policy and create outcomes that have the potential to change public opinion and behaviors in a positive direction.

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