MORECAMBE BAY TIMESCAPES: DRAWING TOGETHER COASTAL FUTURES THAT WILL, MAY, OR COULD.

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This paper considers the role of drawing and creative processes of visualizing possible coastal futures as a means for engaging young people in climate change research and coastal management processes.

While predictive models show the impact of climate change in coastal areas around the globe, what will happen to individual places will largely depend on local strategies and interventions. Yet, the complexity of these phenomena as well as the high level of specialisms involved often tends to leave local communities, and young people in particular, unable to participate decision-making processes which will determine the future of the places where they live.

In the Morecambe Bay Timescapes project, three secondary schools and one college across Morecambe Bay were involved in a programme of activities which combined fieldwork, archival research, climate modelling, and art practice which led to the design of visions of hyperlocal coastal futures. These visions were used as part of an interactive exhibition that brought together young people and experts in conversations about possible futures. This paper describes the role that drawing played in enabling such conversations, by providing a way for students to work through multiple layers of complexity and articulate their reflections.

Introduction: entanglements in coastal futures

This paper is co-authored by a diverse group of researchers with expertise in design, coastal processes, geography, and education – all of whom working and living in Morecambe Bay and interested in the ways in which coastal futures are made (and by whom) in the Anthropocene.

Of all the places shaped by the Anthropocene, coastal areas are arguably among those where the results of the interactions between humans and non-human entities are particularly visible and significant. Coastal environments are the most populated areas of the planet by multiple species, and are sites of delicate dynamics that are being affected by anthropogenic global climate change (Harley et al., 2006).

All the most recent studies agree on the environmental threats that rising sea levels, acidification, deoxygenation, increased likelihood of heatwaves and extreme weather events are posing to coastal and marine environments around the globe. These are detailed in the latest report of the International Panel of Climate Change (2021), which also exposes the impacts on industries, economies, wellbeing, and cultural and recreational activities already being experienced by coastal communities.

Studies are also showing diminished opportunities for maintaining sustainable cities in coastal areas as a result of these phenomena (Day, Gunn and Burger, 2021). When livelihoods are being threatened by flooding, dangerous weather, and economic losses, difficult decisions have to be taken about how to prepare and adapt. The impact of such decisions will then shape futures of individual coastal communities.

In England and Wales, such decisions are partly informed by Shoreline Management Plans (SMP). These are non-statutory documents which provide coastal adaptation pathways at different time scales, or epochs, up to 2100. An understanding of coastal processes and predictions of future coastal changes form the basis of these plans, which in turn require a comprehensive dataset of coastal changes and their drivers. The data informing SMP is diverse and heterogeneous, and includes, for example, beach and dune elevation changes, inshore wave energy, tidal levels and sea level rise (Bradbury et al., 2002). Implementation of non-statutory SMP pathways requires consent and support of all interested parties (O'riordan and Ward, 1997), which is usually sought through consultation. However, consultations with the wider public often lead to miss-communication and resistance (Brown, Naylor and Quinn, 2017; Famuditi et al., 2018; Creed et al., 2018). Moreover, the specialised formats and language used in SMPs can also make them inaccessible and meaningless to the wider public.

Often, these documents disregard the perspectives of coastal communities and the tacit knowledge developed by people who have been affected by flooding and weather events in the past. For this reason, it is crucial to engage, motivate and empower local communities to make informed decisions about coastal futures (e.g. Brown, Naylor and Quinn, 2017; Buser, 2020). Young people in particular are rarely engaged in such processes, despite being the ones who will be most affected by the impact of coastal changes.

Drawings feature heavily in documents describing coastal (and more in general environmental) processes and climate predictions. Here, maps, diagrams, and models are employed for their ability to visualise, in a way that words couldn't, the spatial, relational, and qualitative feature of inherently

complex phenomena. As forms of drawings, they do so by selecting and composing salient information in communicative artefacts aiming to convey clear, tightly edited messages. Often, this is done with the main purpose of increasing the accessibility of otherwise technical documents to a wider audience. But the value of drawing as a tool for research and engagement should not be underestimated.

That drawing plays a role not only in communicating but also in generating knowledge in environmental studies has been widely acknowledged in the literature on the subject (Anderson, 2017; Casey, 2020). Drawing has been used to visualise patterns of change (e.g drawings of polar expeditions by Stibbon, 2014), subjects that are too vast or too small to capture (e.g. drawings of atoms or the solar system) or those that cannot be directly handled and manipulated (e.g. Sarah Casey's archaeological drawings, see Taylor *et al.*, 2023).

Beyond documenting what exists, drawing is also a powerful tool for speculating on alternative realities and possible futures. Speculative drawings allow the drawer to experiment and test imaginaries and ideas – Including those that would be too impossible or hazardous to implement. Drawings of possible futures may employ graphic ambiguity to bring key concept to the fore while allowing for unresolved details (Herbert, 1988). Drawings are dialectical, in the way they present a visual argument to their intended audience (Goldschmidt, 1991).

In her research on the role of drawing in design and architecture, Goldschmidt (1991) found that sketching is often used as a thinking aid rather than as a way of communicating pre-conceived images. Crucially, for architects, artists, and designers alike, drawing imaginary worlds is never a completely abstract practice: memories, experiences, data, and culture are pulled into the drawing (Cook, 2012) which collages the real and imaginary into visual narratives (Lim, 2013). Drawing as a process, in summary, can be used to work through complex assemblages of data and information to produce propositions and possible scenarios.

This paper considers the role of drawing and creative processes of visualizing possible coastal futures as a means for engaging young people in climate change research and coastal management. It proposes a pedagogical approach that brings together fieldwork along the coast, climate data literacy and archival research to inform the design of artistic representations of possible future scenarios presented as stereoscopic Timescapes. In doing so, it explores the potential of using artistic representation as a point of convergence between science and humanities, and to capture and juxtapose observed and speculative, qualitative and quantitative aspects of place at multiple timescales. Drawing, in this project, is used as a key engagement practice, as it allowed students to develop expressive visions of hyperlocal coastal futures that communicate their ideas, aspirations, and fears as responses to climate predictions.

Coastal futures that will, might, and could.

By their own nature, futures carry with them different levels of uncertainty: for any individual future it is possible to speculate on what will, might, or could happen (Bell, 2002). And of course, just like the present, the future is never homogeneous, but characterized by a plurality of coexisting (and often conflicting) realities. In addition, when it comes to complex phenomena such as coastal change, interactions between cultural, political, and social factors should be considered alongside predicted climate patterns for their power of shaping futures that are neither determined nor completely open (Urry, 2016). Even when informed by expert advice, in fact, decisions that shape future trajectories are

always inherently built on knowledge that is plural, conditional, and not value-free (Stirling, 2010). This means that conversations about futures also require ways for developing types of knowledge that can capture and make sense of these interactions and plurality. The purpose of such knowledge is to work through the 'viscous porosity' between nature and culture of the type that American philosopher Nancy Tuana identified in the aftermath of hurricane Katrina in New Orleans. The concept of viscous porosity in this context acknowledges that while individual bodies (e.g. policy makers, institutions, private citizens, water, birds...) might be perceived as different entities, they are also porous in the ways in which their experiences interact and overlap – especially when boundaries are troubled by systemic change or catastrophic events (Tuana, 2008).

All futures, including coastal futures, are inherently pluralistic and uncertain. Current data and models show us how coastal futures will, might, or could unfold, through pathways that are shaped by local policies and interventions. And of course, what the future will, might, or could look like, will be and feel different to different people and in different places. Future visions can be used as a powerful tool to engage people in imagining and dealing with this complexity in coastal space. But it is crucial for these visions to include multiple perspectives and degrees of uncertainty, to explore the ways in which different subjects will inhabit the viscous porosity of coastal environments (Pollastri et al., 2018).

Morecambe Bay Timescapes; engaging young people in research on coastal change.

Morecambe Bay Timescapes was an interdisciplinary project which ran from September 2021 to March 2022. It involved researchers in Design, Computing, and Environmental Science at Lancaster University working with young people around Morecambe Bay to develop visions of hyperlocal coastal futures.

Morecambe Bay

This project was focused on Morecambe Bay, in the North West of England. Morecambe Bay is the largest intertidal area of the UK, and one of the most biodiverse areas in one of the least biodiverse Countries in the World (Hayhow et al., 2019). The mudflats and saltmarshes of Morecambe Bay are particularly important to communities of wading birds, which rely on the rhythms of the tides constantly covering and uncovering the seabed where they forage for molluscs, insects and crustaceans.

The predictable rhythms of the tides also shape the shores and sediments of the bay, driven by the regularity of moon cycles and seasonal patterns. Change can also be unpredictable and destructive, with extreme weather events and storms bringing the possibility of strong winds, heavy rainfalls, storm surges and flooding. Consequently, Morecambe Bay is never still, and historical records can be used to document the movements of shorelines, channels, and salt marshes throughout the years (Pringle (Née Phillips), 1995). The life of communities of humans and non-humans around the bay has historically been redefined not only by tides and weather patterns, but also drastic changes in local economy, infrastructures, and governance that occurred over the centuries. Ancient Viking burial sites, early Christian churches and abbeys, and traces of the Maritime Trade of the 1700's can be found in different locations along the bay. Relics of Morecambe's past economic and social heritage are also visual reminders of lost trades, transport infrastructures and tourism. Young people in Morecambe Bay now grow up with stories (and legends) about the time in which the area was a popular seaside resort, with aquariums, fishing ports, outdoor swimming pools, fair grounds and illuminations.

As a site of intricate and moving entanglements of non-human entities with human-made infrastructures, Morecambe Bay is home to the type of tensions between the unruliness of nature and human attempts of control that Tsing et al. argue are at the core of the Anthropocene (2020). A walk along the coast reveals traces of floods and storm surges of the past, as well as defences that have been put in place to help preserve human activities along the coast. It also highlights the risks faced by buildings and infrastructures that are close to the sea level, raising questions of what should be protected, how, and at what cost.

Making Timescapes

In the Morecambe Bay Timescapes project, a total of 58 Year 9 students (aged 13-14 years old) from three secondary schools and 13 college students (aged 16 years old and over) took part in a programme of workshops and activities, which was led by the research team in collaboration with art and geography teachers at the four schools. The project addressed the lack of engagement of young people in early-stage conversations and decision-making processes shaping the future of local communities in coastal environments. By bringing together information on past and future coastal changes, local knowledge, and personal histories, this project experimented with ways of engaging young people in secondary schools in envisioning alternative coastal futures.
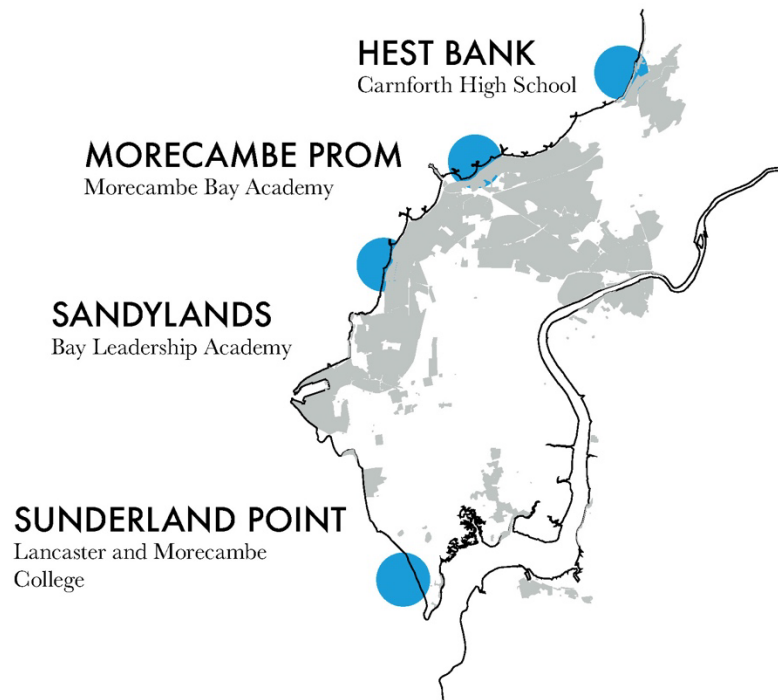

FIGURE 1 LOCATIONS FOR THE MORECAMBE BAY TIMESCAPES PROJECT AND THE ASSOCIATED SCHOOLS

Each school focused on a specific location in Morecambe Bay (Figure 1). For each location, students explored its pasts, presents, and possible futures. This was done through a series of four 2/2.5-hour long sessions delivered at each school. There were slight variations in the sessions that responded to the differences in sites. For example, an artist who makes work about salt marshes contributed to activities at the site where salt marsh was a predominant feature, and in one of the schools the project was run as an intensive 2-days event rather than as weekly sessions. Aside from these variations, the activities were delivered as follows:

- ***Session 1: Noticing the Present***
  A fieldwork session was organised at each site as a walk along the coast to observe the local environment, discuss historical changes, notice local flora and fauna, identify current coastal management methods and spot signs of past coastal flooding (Figure 2). Students were provided with a fieldwork kit consisting of a clipboard, a map, pencil, binoculars, and bags for collecting samples. The walks followed a pre-planned itinerary, but were somewhat informal in nature. We stopped to notice human and non-human activities, such as people fishing or groups of birds feeding on the beach. Each of the three secondary schools focused on coastal areas that are within the school's catchment area. This was intentional, and experiential knowledge of place was a key part of the fieldwork. Students described their memories and experiences of days at the beach, but also made new discoveries and connections, as guided observations encouraged them to look at familiar landscapes through the lenses of coastal processes and environmental change. The maps used in the toolkit were as open as possible so the young people could add their own drawings and annotations, unencumbered by dense map features, but without the 'scariness' of a blank page. At this stage of the process we purposely avoided directly instructing students to sketch or draw, as these terms would have identified, in the educational setting, formalised activities that are usually evaluated by the art teacher as coursework. Instead, we used words such as 'notice', 'annotate', 'collect', 'capture'. Students returned from the fieldwork carrying treasure-troves of shells, rocks, feathers, sticks, notes, bird names and thumbnail sketches. Back in the classrooms, these were used to populate a large map that gathered insights from the fieldwork. This cartography of place was expanded to incorporate textures, smells, materials, and the traces of landmarks that no longer exist.

FIGURE 2 A GROUP OF STUDENTS DURING FIELDWORK

- *Session 2: Analysing the Pasts*
  Working with photos provided by local museum and archives, students built timelines demonstrating how places have changed over time. This session started with an introduction of the key changes that shaped the landscape and urban infrastructure in Morecambe Bay in the past, using pictures and documents provided by Lancaster Maritime Museum, Lancashire Archives, and Heysham Heritage Association. The images vividly captured physical, social, economic and environmental developments: from heavy industry and shipping at the turn of 20th century to the booming tourist industry that followed, from the fashion for promenading in the early part of the century to the excitement of diving and beauty contests in the 50s, all interspersed with the devastation of flooding on human activities.

  These visual materials helped to show how the sites have been undergoing continuous process of change. The purpose of this approach was to help mitigate the effects of climate anxiety (Crandon et al., 2022) by building an awareness that significant changes have happened in the past, as well as to contextualise past and future interventions in their social and cultural context. The message that the session sought to convey is that interventions (including those for climate preparedness) are never implemented in a vacuum. Looking at Morecambe Bay's past helped understand how the way communities live by the coast have changed, and that it can (and will) change again.

  Students worked on images from the archives, and identified examples of transport, work, leisure, sea defenses, and architecture, by tracing, cutting them out. They then collaged each category on a different face of the cube corresponding to the specific decade, sometimes drawing into their compositions with elements inspired by the historical images. Drawing was used in this activity as an analytical practice, which prompted students to look closely at historical images, identify key elements for the timeline and trace them to bring important details to focus while omitting less relevant information.

  All the cubes were then arranged along a timeline (Figure 2). Some of the images used in this activity were related to the family memories the students described during the fieldwork. Seeing images of young people enjoying the beach, the pools, the fairground, or the illuminations as part of the

analytical work of making the timeline, prompted students to consider the contextual elements of individual experiences.

- ***Session 3: Understanding Futures***
  The third researcher-led workshop of the series stared with a masterclass in coastal-management practices, which introduced students to how environmental data are collected and used to build predictive models – and how these models constitute the basis for the design of interventions. Through graphs, maps, and satellite views, students were shown the changes that have been recorded and those that we might expect to happen in Morecambe Bay, but also the uncertainty embedded in thinking about the future, and how small variations may lead to vastly different scenarios. We discussed the ways in which recommendations for local actions (including SMP's) are designed to consider different degrees of uncertainty, and the need for testing interventions against a variety of possible scenarios. International examples of how communities are developing preparedness to climate change and resilience to flooding were presented, focusing on a vast portfolio of interventions, including barriers, but also sand dunes, salt marshes, and community relocation. After the presentation, students used a wave tank and building bricks to design, prototype and test the efficacy of different prevention and mitigation strategies (Figure 3).

- ***Session 4: Designing postcards from the future***
  The creative process of developing future coastal visions was then initiated through a session in which students were asked to design postcards from the future. Students were given a frame for their postcard and a template to write a description of their vision in the form of a greeting card. The template read "Dear [name], This is a view of [something] in [place] where [something or someone] is/are [doing something]". Students worked in pairs to develop the initial postcards, and found the template helpful to facilitate a discussion on the type of future that was going to be portrayed. During the session students were allowed to use different techniques, and to incorporate pictures produced or provided in the other sessions. While in some cases the visions produced for the postcards were developed into the future outputs, the main purpose of this activity was to start a process of turning the insights developed through the different sessions into tangible imaginaries (Figure 4).
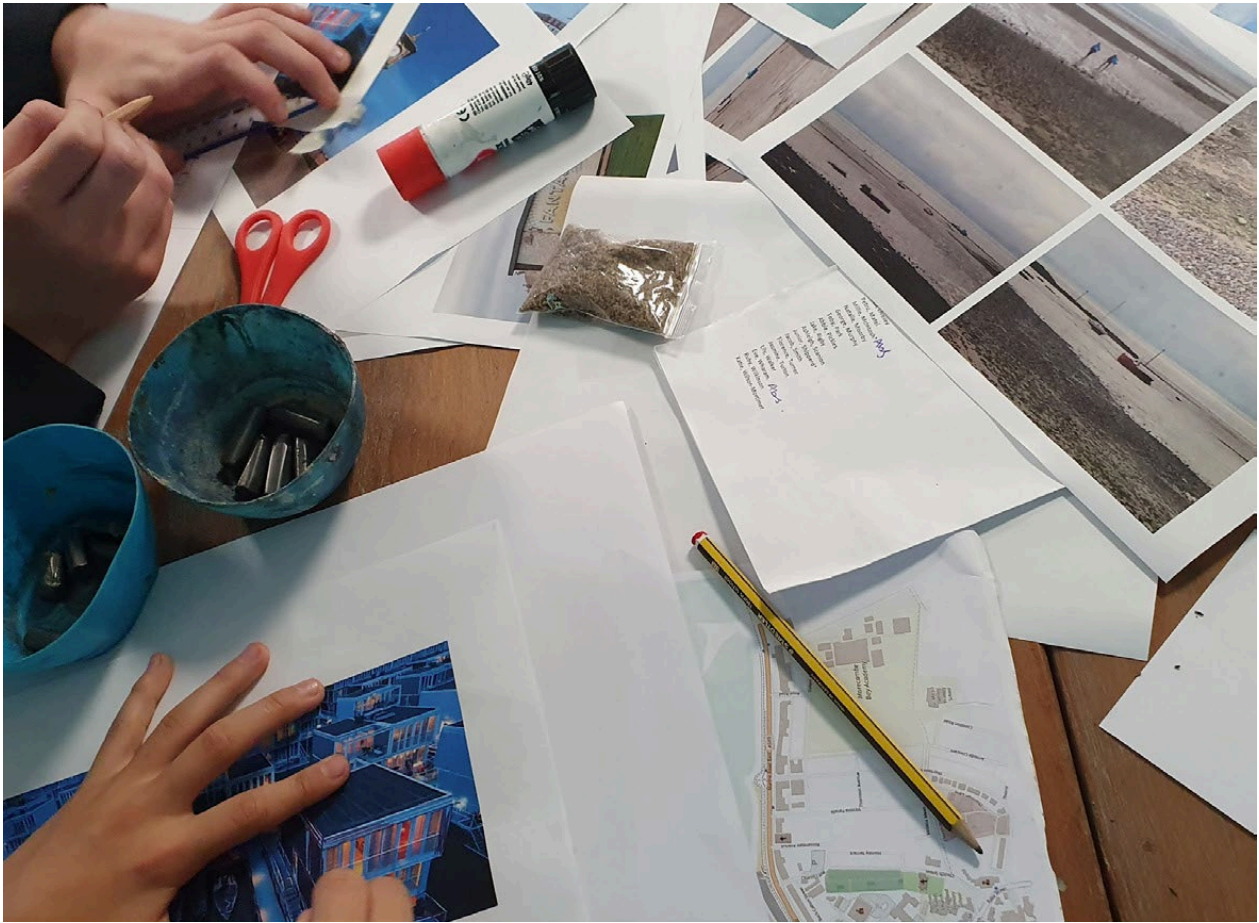
The teachers then went on to leading and supervising the activities in the two months that followed. As a result, each of the secondary schools focused on one specific technique (ceramics, digital media, collage), while students from the college explored a number of techniques (from print making to digital illustration) and developed mixed media artworks. In January we received all 54 visions from the 4 schools. These visions were created either individually or in groups of 2 to 4 students.

A final event was held on 11 March 2022 at the Midland Hotel in Morecambe. Approximately 90 people attended the event, including 52 young people and 22 invited experts who lead discussion tables with the students. The list of experts participating in the event included representatives from local cultural and environmental organisations (Wildlife Trust, Morecambe Bay Partnership, Lancaster Maritime Museum, Heysham Heritage Association), members of Lancaster City Council, a nature writer, a historian focusing on Transatlantic Slave Trade, architects, representatives from the Environment Agency and North West Coastal Monitoring Programme, and a local artist.

The event was structured around two spaces: a room for discussion tables and the exhibition. Around the discussion table young people and experts discussed their view on the future of the Bay; students led the visit to the exhibition and described their work and artistic process (Figure 6, Figure 8).
This final event was as much of a celebration of the students work as a platform for experts and students to engage in rich conversations about coastal futures. In some cases, some of the ideas presented in the

students' visions were used by experts to illustrate and explain actual interventions that are being discussed and planned for the area (e.g. flood walls, regenerated saltmarshes etc). Students asked questions and expressed opinion on the desirability of different options. They used their artworks as boundary objects that facilitated complex conversations, and helped mitigating power dynamics, language barriers, and hesitancy in speaking out.

FIGURE 6 IMAGES FROM THE FINAL EVENT

The visions designed by the students were digitalised by the research team, and printed as reels of stereographic images which were included in a series of zines presented at the event. Stereoscopic images (stereographs) are pairs of images in which elements of the foreground are displaced slightly to create a 3D effect when these images are viewed through a device called stereoscope. Bespoke stereoscopes were designed and produced for the project, and presented at an interactive section of the event (Figure 7). Loosely inspired by the coin-operated telescopes often found along the coast in Morecambe Bay, the stereoscope were placed by windows overlooking the sea. Unlike the telescopes, which are used to look at faraway places around the bay, the stereoscopes were used during the event to look far ahead in the future, through lenses of the visions designed by the students.

FIGURE 7 STEREOSCOPES WITH REELS OF IMAGES

Drawing Timescapes to investigate and communicate coastal futures

Drawing was used in the project for many purposes; to collate and synthesize multidimensional data, to organize aspects of space and time; to imagine and speculate; to concretize and communicate visions and to provoke discussion.

Depending on the chosen definition, it could be argued that some of the finished artwork produced in the Timescapes could not be strictly defined as 'drawings'. For example, one school created ceramic panels; another school used paper collage with pencil drawing,; the third school's imagined futures were created with digital drawings; the college students had art sessions across different media to support the production of mixed media images. However, drawing as a process of 'articulation of space by means of mark' (Ashwin, 2016, p. 204) is at the core of the way in which students developed their ideas. They did so by bringing together the notes, images, data, textual documents, questions, and experiences collected through the four core sessions in the sketches that informed the final artworks.

Drawing was used in this project as a practice of both generating knowledge and communicating ideas about speculative futures in a more accessible way with students who would otherwise be alienated by the specialist language and formats of representation typically used in climate science. This was particularly evident with some of the students attending the art and design course at the Further Education college who had previously struggled with standardised practices of teaching and learning in secondary school. These students were initially reluctant to engage, with some of commenting on how they had failed geography or science in the past, and were not the 'right people for this kind of things'. Some hadn't studied geography or science, the subjects through which climate change is typically addressed, since Year 9. Climate change affects everyone, but the educational structures can limit who is included in these conversations. Crandon (2022) identified open discussion as one of the key factors in mitigating climate anxiety in schools, but this raises the question of how to facilitate these discussions beyond science and geography. The fieldwork sessions, organised as walks on the beach were an initial step for breaking down these barriers and made issues explored by the project relevant and relatable. In discussions about pasts, presents, and futures of the bay members of the research team were able to

refer directly to signs and elements of place, while students shared family stories and past experiences. Walking as a group enabled a shared experience of thinking about and getting to know familiar places from different perspectives. Walking along the coast also meant moving through a zone that intersects weather, ground, and water (Ingold, 2010), which brought an embodied and sensorial understanding of climate issues.

After these walks the students produced initial drawings (or in some cases collages from photos) which captured individual impressions and specific elements of place, including atmospheres, infrastructures, buildings, animals, sands, seaweed (Figure 8). The students also experimented with different scales, combinations, and interpretations in these initial drawings, which, in most cases, acted as a starting point from which to develop their visions of the future. Students interrogated and contextualised what they learnt from the "Futures" sessions by overlaying effects of coastal change onto their representations – sketching design interventions, reconfiguring relations, or introducing new elements to the existing landscape. As a process of generating knowledge, drawing allowed students to test ideas and scenarios, bringing tangible yet speculative located answers to the "what if" questions that climate models posed.
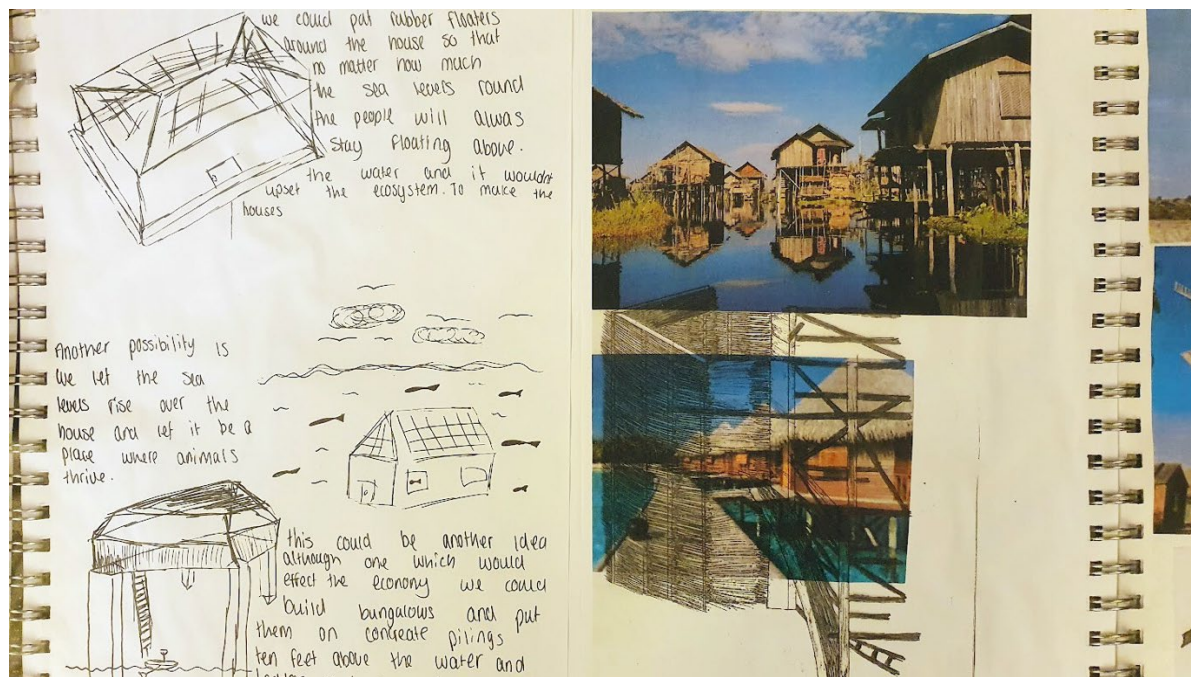

FIGURE 8 PREPARATORY SKETCHES IN A STUDENT'S NOTEBOOK

In considering the 'what if', art provided the students with a creative way of representing their visualisations for how this climate future may play out in the four coastal areas are Morecambe Bay. Art allowed the students to offer new perspectives on what we perhaps could and should value in future coastal space, imagining abandoned wildness at Sunderland Point, modernised housing at Heysham and Carnforth which adapts and draws energy from sea level rise, and even a sense of fun with the development of a new theme park in Morecambe. In doing so, art presented a medium for the students to design alternative and difficult futures which coastal managers and planners may be unwilling or unable to discuss, including questions such as 'why don't we just let it flood?' Coastal managers are burdened and constrained by the bureaucratic entanglements of current ways of 'doing' coastal

management planning; including SMP scenarios, cost benefit ratios, legislation, legal frameworks and managing authorities; things that the students could enjoy an innocent freedom from.
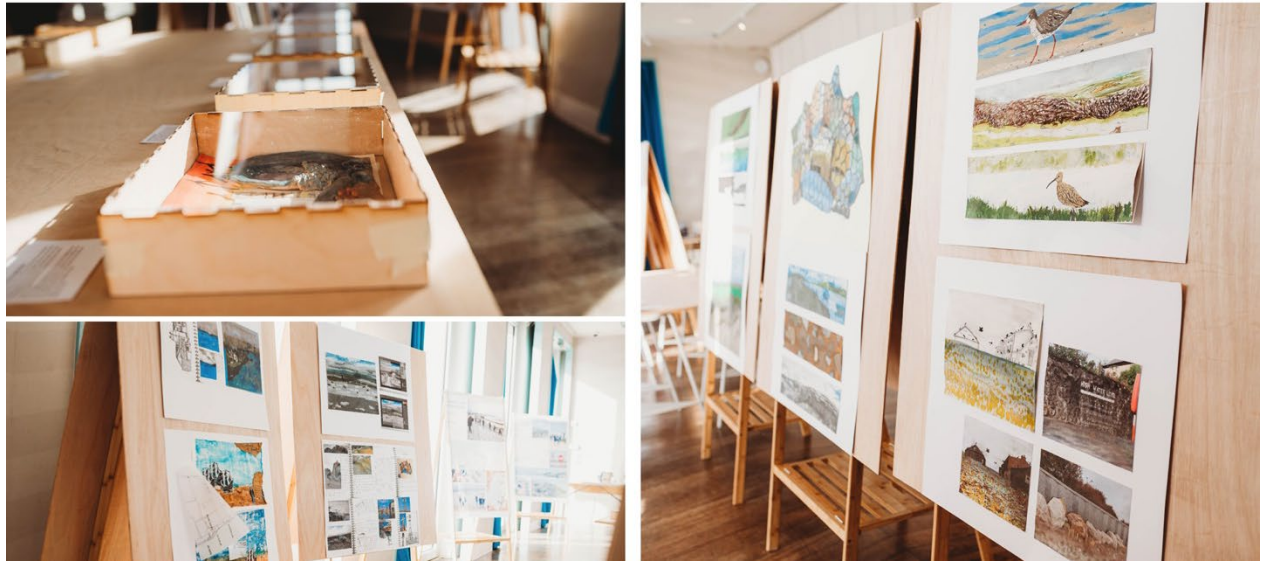

FIGURE 9 SOME OF THE STUDENTS' WORK AS EXIBITED AT THE FINAL EVENT

Drawing what will, might, or could

In addition to the role of drawing in enabling students to engage in conversations about possible futures, the visions produced by young people can also be analysed through a social semiotic approach to appraise their communicative value. The artworks developed as part of the Timescapes of Morecambe Bay project are multimodal artefacts (Kress, 2009), as they combine different modes (drawing, photographs, text, sculptures, patterns) in meaning-making assemblages. With different modes having different 'modal affordances', defined as the capabilities of making meaning or expressing ideas (Jewitt, 2011), a key question that was asked in the project pertained to the role of artistic representation in communicating complex issues related to climate change and coastal futures.

Visual representations of possible futures have been widely used to inform strategies and to build shared imaginaries (Dunn and Cureton, 2020). This is largely because drawing allows nuances and experiential qualities to be captured, and ambiguity and uncertainties to be communicated. In a field such as climate science, in which complexity is often presented through the language of diagrams and charts, drawings can be a powerful tool for communicating the full spectrum of epistemic modality that future thinking entails (Kress and Van Leeuwen, 2006). In other words, future scenarios can be drawn in a way that modulates what futures will, might, or could look like. Informed by observations, historical data, future predictions, but also experiences, fears, and aspirations, the Timescapes designed by young people incorporate all of these modalities, often within the same scenario.

The degree of certainty of something to be part of the future was in most cases found to be not absolute but contextual to the individual scenario being considered. This at times sparked interesting conversations within the group. Historical buildings along the coast were preserved (and therefore left unchanged) in some of the visions, and destroyed in others. The students who decided to preserve these structures often did so because they took them to be key landmarks of place, and assumed that because of that they will be preserved in the future. However, other students questioned this certainty, and speculated on alternative possibilities: should nature be let to take over? Should landmarks be

relocated? Does it make sense to invest in interventions which are expensive to maintain? As different futures were developed by students, lively debates on the qualities and value of the natural and built environment emerged within the groups. The drawings ensured that the connection between the place and climate-related change was always present, in the periphery, if not directly represented. Climate change is often presented in global terms, that can feel distant and abstract in both space and time. The drawing techniques used brought it closer and made it tangible, by asking questions about, what might happen to this building? How will happen to the wading birds who live here? What will this view look like in 1o years, 100 year, 1000 years?

A sense of complexity was found in the student's art work. This was found not only in the art itself, with the different schools and students using different artistic techniques and materials, but in the messages found within their art. For example, although the students were all guided by the same data about future coastal climate change, including sea level rise predictions and flood maps, the students had different ideas about how that 'data' will play out into the future. Some futures were political, imagining a coastal space of conflict and war, some were ironic, whilst some prioritised sustainability and adaptation to climate change (see some examples in Figure 9). The activities in the project allowed the students to think in different ways and explore different realities, offering more than a single way of imagining a problem as large, abstract, and complex as the impact of climate change at the coast. Through art, students could express values and messages not currently captured by current ways 'doing' coastal management, but could offer a useful addition to it, as capturing a diverse range of voices and visions could provide a more holistic and human perspective for how we adapt and work with climate change at the coast.
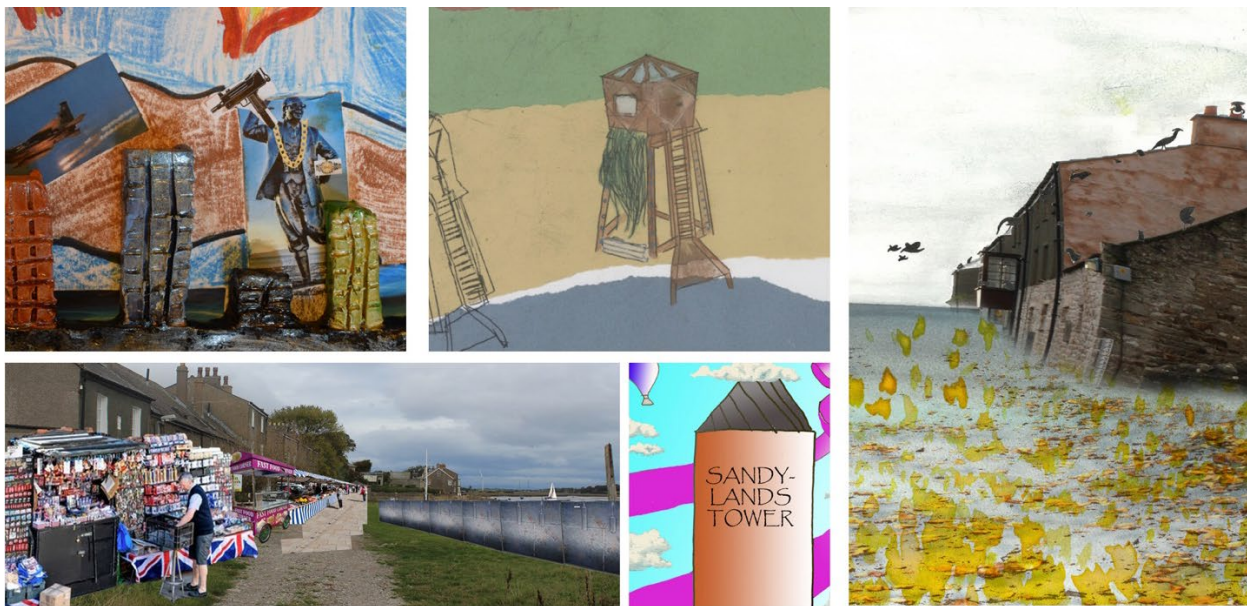

FIGURE 10 DETAILS OF SOME OF THE STUDENTS' DRAWING

Seeing through the eyes of a storm surge

Storm surges are considered to be among the most disastrous weather events to hit coastal areas like Morecambe Bay. Formed by a combination of low atmospheric pressure, which increases the water level proportional to the drop in atmospheric pressure, and strong winds driving the water landwards, they can cause wave overtopping of coastal defences and extensive flooding. However, although a storm

surge causes these coastal dangers, their damaging impact is instead related to the complex entanglements of the Anthropocene.

These entanglements are eloquently described in the work of Nancy Tuana on the viscous porosity between nature and culture that has been briefly introduced earlier on in this paper. In order to understand the role of the entanglements of the Anthropocene, Tuana invites the reader to look at the flooding and destructions experienced by the city of New Orleans through the eyes of Hurricane Katrina, "a natural phenomenon that is what it is in part because of human social structures and practices" (Tuana, 2008, p. 192). In order to understand the destructions brought by extreme weather event, Tuana argues, it is important to also look at the past, and understand how these structures and practices came to be and to generate place as we know it.

Morecambe Bay, seen through the eyes of a storm surge, is also a site of entanglements that are not simply there but that are constantly made, unmade and destabilised through human and non-human interventions. Acknowledging the temporal nature of these entanglement is essential to understand the way in which pasts, presents and futures are made – and how they can be questioned. Using collage, tracing, and speculative drawings, young people brought multiple temporalities to their visions. The future they created are not built on blank canvases but acknowledge the complex evolutionary nature of entangled places.

Drawing coastal futures as a plan for action

Young people in Morecambe Bay will, in their lifetime, experience the impact of climate change hazards such as flooding, sea level rise, storms, and changing eco-systems. Yet, all of the schools who have been involved in the project highlighted a difficulty for young people to understand the local impact of climate change, and the ways in which global patterns of change will meet the viscous porosity of local social, political, and cultural entanglements. As a result, young people are often overwhelmed by the complexity of climate issues, and deeply concerned about their future.

Concern is a rational response to the threats of climate change, especially where 'adaptive anxiety' inspires action, but if anxiety becomes overwhelming, it can be paralysing. Hence Crandon (2022) proposes that in education setting climate change should be "framed on action", with "open discussion", creating "opportunities to engage with action" (p.126) The drawings were envisaged as a tool for action; a way for the young people to enter discussions with experts about Morecambe of the future and all that entails with respect to the climate crisis. The drawings are a place where experts and young people can meet and discuss openly fear, challenges and opportunities. They are a conduit for sharing stories and experiences. They are a jumping off point for future action and conversations.

In Morecambe Bay Timescapes drawing was used as a practice that enabled students to work creatively with heterogeneous data (from fieldwork observation, memories, historical archives, and coastal monitoring) and effectively engage with their entanglements to speculate on possible futures. Doing so through drawing enabled them to embrace uncertainties and pluralism, by testing out possible and unlikely solutions alongside probable trends. The beauty of the visions, especially when viewed one after the other as alternative realities through the stereoscope, is that they question and expand the range of possibilities for the future, as well as their acceptability.

The value of exploring uncertainty and pluralism through drawing is not limited to the issue facing Morecambe Bay in the future. In an article published in Nature, Stirling (2010, p. 1031), commenting on the importance of embracing uncertainty in science communication remarks: "In my experience, it is the single definitive representations of science that are most vulnerable to political manipulation. Plural, conditional approaches are not immune, but they can help make political pressures more visible."

At the time of writing, Morecambe Bay Timescapes is being documented and reworked into a set of pedagogical resources which will be made available to other educators and communities interested in exploring climate futures through art and stereoscopic visualisations.

Acknowledgements

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