Will Industrial Decarbonisation Produce Resilient Communities?

Fig. 1 Top: RWE NetZero Centre, Pembroke. Below: Tata Steelworks, Port Talbot.[1]

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[1] Photographs, Harriet Smith

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Summary: Will Industrial Decarbonisation Produce *Resilient Communities*?

This report provides an explanation of key research findings from the IDRIC / FLEXIS funded project entitled: *Understanding Public Responses to Industrial Decarbonisation in Insecure Times*. The research undertook deliberative workshops in South Wales, the second biggest industrial and power carbon emitting region in the UK. The workshops were carried out in 2022 at Port Talbot and Pembroke Dock, sites identified for new technological energy infrastructures. Currently there is growing research attention to communities undergoing re-industrialisation through industrial decarbonization strategies, but a lack of granular understanding of the global and local uncertainties as framed through Ulrich Beck's World Risk Society thesis.

The report is underpinned by conceptual framing that elucidates:

- Ulrich Beck's World Risk Society thesis extended through interpretive risk theories to explore the ramifications of the new normal of risk.
- How material fabrications enact with cultural experiences, termed infrastructural ecologies.
- Psychosocial logics explicating impacts, resistances, and resilience to change.
- Attention to how social, spatial and reparative justices may be achieved.
- Empirical data gathered through affective, visual and discursive workshop tasks.

Key Findings Summarized in this report are:

1. Reading **Atmospheres of Place** provided insight into community resilience and stability. Port Talbot was identified as a contained atmosphere of place whereas Pembroke emerged as a wounded ecology.

1. **Global and local** interrelations are active in the construction of resilience.

2. Living with ongoing **risks and uncertainties** produces expected and unanticipated responses to change.

3. Stakeholder **visualisations** can enact as signifiers of distances between industry, government and local people.

4. Psychosocial mechanisms such as **denial and idealisation** explain processual deliberations for change and resilience.

5. **Achieving an understanding of acceptance** requires analysis of mechanisms involved in articulations of hope and idealisation and through **reparative and coping** strategies.

We conclude with a final section arguing that there are opportunities for policy and industry to co-produce changes pathways through attending to how visions are received by local people. Conversely making good on past wounds can build trust and stability, materialising productive actions for local people.

1. Introduction

The research investigated how trade-offs between industrial decarbonisation and the construction of resilient local communities could materialise in developing a secure UK industrial-base to achieve NetZero by 2050.

Achieving energy transitions and industrial decarbonisation presents a challenge that requires changes to land and sea infrastructures, transportation fabric, and development of a large skilled workforce (Carr-Whitworth, 2022; Pathak et al., 2022; GO-Science, 2023; Collins et al., 2021). Impacts from new technologies and large infrastructure fabrications will reach across localised sites to wider regional infrastructures, economies, and transport routes. Consequently, decarbonisation strategies are being developed and scrutinised at multiple scales by cross sector and in many cases transnational global networks of stakeholders. Yet it is people who live and work locally within energy transition sites who will most intensely experience the industrial decarbonisation transition. It is widely understood that views of local people must be taken into account (Pidgeon, 2021, p.2; Wilsdon and Willis, 2004). However industrial change and energy transitions related public engagement research remains instrumentally shaped (Longhurst and Chilvers, 2019) by corporations (comms agendas), governments (planning frameworks and policy), and academics (funding priorities, disciplinary gaps and blind spots). This report responds to interest within environmental and sustainability studies questioning what meaningful public engagement on industrial decarbonisation change entails (Otto et al., 2022; Groves et al., 2022; Sovacool et al., 2023).

One way to draw together sociologies of the everyday (Lefebre, 2014; Jacobson, 2009), and place orientated social research (Devine-Wright, 2009), with macro theories of risk and uncertainty (Beck, 2009; Giddens, 1991; Mythen, 2021) is through the 'turn to infrastructure' within cultural anthropology and urbanism (Venkatesan et al., 2017). This project utilised the lens of 'Infrastructural Ecologies' as a means to explore how subjects are constructed by, and engage with, material, cultural and psychic objects cross-temporally, and at multiple scales (Venkatesan et al., 2017; Larkin, 2013). Further, in order to respond to stakeholder plans for achieving industrial decarbonization the research design incorporates visual tasks enabling research participants to engage with vision-plans as situated within affective infrastructural ecologies. Attending to material fabrications as visceral, aesthetic and political (Knox, 2017) invited additional data analysis that utilized affective and psychosocial frames, with much to offer environment research (Lertzman, 2012, p.176).

1:1 Situating: South Wales, Port Talbot, Pembroke /Dock

South Wales is the second biggest industrial and power carbon emitting region in the UK, due to the presence of heavy industry and power generation facilities[2],[3]. We selected research locations with the two largest emitters, the first workshop in Port Talbot is home to Tata Steelworks (the UK's largest steel producer), and the second workshop in Pembroke Dock where major oil and gas refineries and storage facilities at Pembroke and Milford Haven are located alongside the RWE NetZero Centre at the Pembroke Gas-fired Power Station. The decarbonisation vision plans can be viewed via links in the footnotes. But for the purposes of understanding our report a short explanation is necessary. In Port Talbot, there are proposals for decarbonisation of the Tata Steelworks while The Association of British Ports (ABP)[4] in partnership with SWIC and Neath Port Talbot council have produced the Port Talbot docks vision including a hydrogen and carbon docking area, and infrastructure to upload wind turbines (potentially fabricated at the steelworks site) ready to be towed out to off-shore wind farms. There are further plans afoot involving the development of anchor sites where industries can work

[2] In this report we discuss plans and visions as published at the time of the workshops August-Dec 2022
[3] South Wales Industrial Cluster: https://www.swic.cymru/clusterplan
[4] Association of British Ports/ Port Talbot https://www.abports.co.uk/future-ports-port-talbot/

together to share resources acting as hubs for businesses to utilise greener energies and potentially for the collection and transportation of carbon. In Pembroke the plans are based around the Celtic Freeport partnership[5]. Plans involve developing Pembroke Dock capacity for off-shore wind turbine assembly and maintenance, towing components out into the Celtic sea, and basing long-term maintenance teams there. There are also plans to develop power lines from the windfarms to land near the RWE Pembroke NetZero Centre (PNZC)[6]. The PNZC has plans to decarbonise its energy generation through carbon capture and storage (CCS); to investigate burning hydrogen in the power station instead of natural gas; and conduct feasibility studies for green hydrogen production including a 'pathfinder' electrolyser. Both workshop locations are home to several demonstrator sites for research into hydrogen on-shore transport hubs, wave and tidal technologies, solar array infrastructure and civil engineering for future buildings.

The South Wales coastal area is a ribbon of towns, beaches and industrial zones built up since the 1800s during the heyday of coal and related manufacturing. We conducted research at Port Talbot and in Pembroke Dock (covering also Pembroke town, Neyland and Milford Haven). The spaces and places that these represent do not sit neatly within generic categories of 'place': rather they have rhythms alive with unique ecologies that are more than the sum of their localised material infrastructures through their embedded global networks (Amin, 2014). The towns share attributes aligned to industrialisation and port infrastructures. However, they also differ in many respects. Pembrokeshire is home to South Hook, Dragon LNG, and Valero global refineries based along the mouth of the large river Cleddau estuary known as the Milford Haven Waterway. Port Talbot sits between hills and the Bristol Channel and has deep rooted communities connected via the steelworks and a long mining and industrial heritage. Port Talbot is closely connected via motorway and mainline railway to nearby cities, including the Welsh capital Cardiff. Pembroke Dock is situated on a peninsula, and while the towns of Pembroke, Milford Haven and Neyland are nearby, they are small, with no motorway or major railhead. Although industrial, the Pembrokeshire refineries are disconnected from the area's earlier history of fishing, ship building and as a naval military base. So, whilst the two field-site landscapes share many attributes - de/industrial pasts, presents and futures, coastal, Welsh – each category as a comparable object soon dissolved without much closer inspection: given that their industrial pasts weald from different industries utilising differing skills, conditions, life-spans, and local rewards and risks. The coastal characteristics differ too. The Pembroke area has towns dotted each side of the river Cleddau estuary which weaves through the long peninsular, lined with coves and beaches and facing towards open sea while also providing a series of safe deep-water anchorages for oil and gas tankers. By contrast, Port Talbot sits on the Bristol Channel enjoying a wide sandy bay, sheltered by the Gower peninsula and the city of Swansea on one side. A chain of settlements are held between beach and hills with the mining valleys beyond. As the research unfolded the differences between the two locations expanded, and this is evident in the following analysis.

[5] Milford Haven Port Authority https://www.mhpa.co.uk/our-services/celtic-freeport/
[6] RWE Pembroke NetZero Centre https://uk-ireland.rwe.com/innovation/pembroke-net-zero-centre-pnzc/

Fig. 2 Pembroke Valero Refinery.[7]

2. Transdisciplinary Conceptual Framework

2.1 Risk and Uncertainty: Globalised and Local Interconnectivities

We aimed to investigate the implications of how global and local structures are affectively entwined in ways that influence how people engage with proposals for industrial change (Henwood, 2022). Interpretive risk theories explore risk and uncertainty whilst paying attention to general theories addressing macro structures, and theories of the everyday (Świtek and Abramson, 2022; Tulloch and Lupton, 2003). There are now confluences of ongoing risks across the globe (health pandemics, environmental catastrophes, wars), with chains of further consequential anticipated and experienced uncertainties associated with food scarcity, poverty, migrations of peoples and increased social divisions. Fears are at one and the same time experienced directly localised in place, but also by people worldwide through media transmission and the impacts of globalisation (Morris, 1993; Featherstone, 1993). The impacts of actual disasters and anticipated risks are felt in differing intensities according to cultural norms, wealth, and material interfaces (Henwood et al., 2008, Brock et al., 2021).

Social theorists have argued that, in parallel with globalisation, there has been an erosion of universal social norms, with people identifying more as individuals, constructed reflexively through choices and opinions (Beck, 1992; Giddens, 1991; Beck and Beck-Gernsheim, 2001). Beck and Giddens argued that government strategies have produced laws, and communication strategies that curate fear and risk, constructs that in turn are responded to, and in many cases amplified by, independent media outlets (Pidgeon et al., 2003) and social media (Walsh, 2020; Goode, 2009). Cultural enclaves and society-wide tools impact on anticipated risks and

[7] Harriet Smith with Google Maps 'street view' images composite

fears across communities(ibid). Increasingly, as Beck argued, people experience life less through a value system orientated towards freedom to one orientated towards aspirations to feel secure (2009).

The shifting evolution of homogeneous communities, towards a portrayal of individuated subjects dis-embedded from community has been critiqued and re-worked by scholars involved in granular research with local communities (Dal Gobbo, 2023; Walkerdine and Jimenez, 2012. '[L]ife practices are embedded in intersubjective relations, personal affects, and wider sociocultural and material infrastructures that partly determine them' (Dal Gobbo, 2023, p.24 citing Henwood et al. 2015; see also Henwood et al., 2016). There remains a tension however between understanding how subjecthood is constructed in relation to wider (global and local) cultural constructs and determinates. In this sense 'what makes a life worth living, remains open' (ibid; Le Coze, 2017). Granular inquiries seeking to understand how people live in insecure times are attentive to their ways of responding to shifting situations, how they take up meaningful social positions, and deploy specific mechanisms – and with what impacts (Henwood and Pidgeon, 2015, 2016). For this reason, interpretive risk researchers and aligned environmental scholars are interested in the psychosocial dimensions of climate change and decarbonisation agendas.

2.2 Responding to Calls for Social Justice: What Objects are Relevant?

This project is of value to policy makers in that we provide empirical explanations of how objects, as material installations and as psychic responses and attachments, come to matter. In this way we illuminate how decarbonisation of industry could develop co-productively with shared goals amounting to a future that democratically attends to civic needs in place. Thinking cross-temporally, as Sovacool et al. have recently argued, is required in order to understand place attachments in relation to deindustrialisation and aligned industrial ruination (2023, p.15). This elides with the notion that in order to achieve just transitions, reparative solutions (to past problems) need to be incorporated into future plans (Upham et al., 2022). Consequently within the environment and climate change fields and policy there are growing calls and attention to concepts of social justice throwing light on inequalities wrought through energy transitions, involving spatial and political impacts (Longhurst and Chilvers, 2019; Brock et al., 2021), and cross-temporal industrial economic activities (Upham et al, 2022, p.3). These foci and concerns share calls to conduct further research in order to fathom out what is at stake and for whom (ibid, p,7). Determining what objects are relevant to peoples' infrastructural ecologies is essential in order to achieve social justice in relation to the decarbonisation pathways (Sovacool et al., 2023; Pathak et al., 2022). Or as Bruno Latour put it, to know 'how many participants are gathered in a thing to make it exist and to maintain its existence' (2004, p. 245).

2.3 Reading Place as Infrastructure

We draw on recent interest in infrastructure as a means of addressing gaps in understanding of the dynamic, affective, and material aspects of place. This is especially relevant to the industrial locations we are interested in because as Ash Amin puts it: 'The [se] hyper-visible and constantly evolving infrastructural developments make the atmosphere of place that forms the precognitive of mental, sensory and affective dispositions: the residents' experience of living …' (2014, p.146). 'Infrastructure' includes constantly evolving material fabric (the wires and pipes, concrete, glass and stone that make up built space). Critically infrastructure also includes the political will enacted through plans and visions; and the interfaces and relations connecting objects with people whose lives are settled there or who pass through (Amin, 2014; Venkatesan et al., 2018). Attending to infrastructure in this way foregrounds that, as Sareen and Grandin articulate, '[p]laces are not geographically bounded but constituted by the relations and flows of which they are part' (2020, p.104). The 'flows of which they are a part' in South Wales may be supply chains from across the planet, governance from a distant authority, decisions

made in boardrooms situated in other continents. Moreover, there are more mundane flows - for example to relatives or working life elsewhere, media and holidays that enliven people to other perspectives, attachments to brands, hopes or possibilities. So drawing on the turn to infrastructure also provides a framework to investigate how global and local are entwined concepts (see also Devine-Wright and Batel, 2017), materially evident in spaces where global industry is present. Although environmental studies and policy attend to social impact frames by emphasising ethical strategies and reparative solutions to change, there remains a gap in our understanding of the psychosocial and affective relations entwining people across localised and global infrastructures (Dal Gobbo, 2023). Attention through the lens of infrastructure shifts attention away from fixed sociological objects (class, gender etc.) towards investigating what is active in shaping experiences cross-temporally and at multiscale.

2.4 Affective Infrastructures, Images and Visions, Psychosocial Logics

Affective Infrastructure

Scholars interested in infrastructure have noted that material fabrications and images share many sensory and aesthetic attributes (Harvey and Knox, 2012; Knox, 2017). Latham and McCormack argue that "The aesthetic is not some representational veneer laid across the real materiality of life....[rather it is] part of the generative, distributed expressiveness of the city."(2009, pp.260/1). People form opinions in part based on experiences of being in relation to the built environment (Amin, 2014; Latham and McCormack, 2009) as well as landscape (Ingold, 2000). Material infrastructure can be understood and read as 'living signifiers' through following the aesthetic frameworks that 'speak' to people in a myriad of ways enacting double roles beyond techno-functionalities (Larkin, 2013, p.329). Thinking about the new energy decarbonisation proposals as 'living signifiers' is especially salient as the aesthetic and sensory signifiers are likely to be loose (less socially coded), and therefore how people engage with the new installations is less established and may involve unknown new forms of iconographic experiencing and ideations (Hinshelwood, 2012, p.236).

Images and Visions

A central strategy for the research design was the use of photographs operative both as depictions and affective objects, that people identified with as parts of their everyday material fabric. As Gillian Rose explains people can 'engage[s] with the agency of material objects by using photographs to evoke its brute thing-ness, there-ness, that words cannot convey.' (2008, p.156). In fact there are several good reasons to utilise visual tools in the current research. We live in ocular-centric cultures, where much of the way we communicate is through images (Hariman and Lucaites, 2007). Relatedly, the stakeholder communications in South Wales often rely on visualisation tools (e.g. infographics, CGIs and photographs). Professional 'visions' are utilised as a means of reimagining and articulating spaces (Metze, 2020). Moreover, like the material infrastructures that the visions portray, such visions are political because they enact forceful descriptions of possible futures, endorsed through powerful affiliations and formal structures such as policy frames, media outlets and planning structures (Metze, 2020; Longhurst and Chilvers, 2019). Thirdly, images like material infrastructures are affective. As such they are useful research tools for discovering what kinds of intensities and interrelations are activated through visual engagement with both material fabric and professional future visions for change. There is growing academic attention to the import of decarbonisation images and visions in public messaging from stakeholders, and as potent tools for achieving engagement with publics in research (Biddau et al., 2022; Metze 2020). We have utilised visual tools for public engagement and in a variety of ways that span social science and deliberative research (Longhurst and Chilvers, 2019; Henwood et al., 2020; Henwood, et al., 2018; Smith; Pidgeon and Henwood, in press). We consider the otherwise relative lack of attention in energy and sustainability research to publics' multi-layered engagement with images to be a missed opportunity in academic public engagement

research. Images affect people in ways that shape their evaluation of risks (Pidgeon, Kasperson and Slovic, 2003) and public acceptance (Vespa et al., 2022). Moreover, psychosocial research has deployed visual narratives to temporally reframe, re-represent and re-imagine identities and, in this way, produce understanding of 'identificatory dynamics' (Henwood et al., 2018, pp.10-11).

Psychosocial Logics

Psychosocial logics have been utilised to illuminate how infrastructural ecologies (constellations of both material and cultural objects) produce 'atmospheres of place' (Amin, 2014), and in this research we have drawn on a number of psychosocial concepts. Firstly, we have considered whether the infrastructural ecologies enact as spaces of containment, where people experience overall stability and integration of ongoing fears and uncertainties (Randall, 2012; Lertzman, 2012). A central theory of psychosocial logics is 'object relations' developed by Melanie Klein (1935), where the psyche is understood to split objects into ideations regarded as wholly bad or wholly good (Keene, 2012). Splitting can involve idealisation of good objects, as well as othering or demonisation of bad objects. We were attentive to potential ecologies expressing instability; e.g. where overwhelming forms of 'rupture' or wounding may be managed through splitting defence mechanisms such as denial, sometimes manifesting as a literal refusal to 'see' problems or fears at large (Gugg, 2022). Lastly, we were looking for evidence of reparative processes (Lertzman, 2012) where the splitting of goods and bads become integrated, through affective and cognate weighing up of infrastructural objects.

Fig. 3 'Contained' Port Talbot.[8]

[8] Photograph, Nick Pidgeon

3. Findings

3.1 Reading Atmospheres of Place

The first stage of analysis constructed atmospheres of place through the capture of ascriptions from visual and mapping tasks (see table, Fig. 5) including noting how relations between selected image-objects were explained. In this section we firstly provide an explanation of how the Port Talbot workshop was interpreted as presenting a contained, resilient atmosphere of place. Following psychosocial object relations theories, we consider that when there are enough good objects, fears and uncertainties can be safely experienced and contained within the overall psychic structure (Rustin, 2012; Randall, 2012; Lertzman, 2012). Containment involves the ability to integrate both 'goods' and 'bads' to form stability and resilience (ibid). We then explain how conversely the Pembroke workshop presented a wounded atmosphere of place. The wounded portrayal was evidenced through psychic and material losses evident across infrastructure objects producing an uncontained and unstable ecology. The atmosphere of place analysis provides insight into the overall affective experience of place as well as signposting to specific active material and psychic objects that emerged generatively during the workshop tasks.

Contained

Resilience can be read through the lens of Atmospheres of Place, elucidated from analysis of the ongoing object relations, that signpost towards solutions for achieving social, spatial and reparative justice. In Port Talbot we characterised the visual tasks as portraying an atmosphere of place depicting containment. Participants expressed connections and interrelations across a broad range of objects as well as forming narratives during the constellation task (Randall, 2012, p.173). In Port Talbot there were frequent ascriptions relating to family, friends and community, for example *'my town', 'home', 'heart of Port Talbot', 'family and friends'*. There were also positive attachments to past objects: *'happy days'* as well as nostalgia and sadness about the past. Overall interrelations emerged for a wide range of lively objects and many participants also selected new technology images, for example a combined on-shore turbine and solar image as well as one of a hydrogen sea-tanker. Both of these latter images received temporal ascriptions relating to the future: *'the future of energy';* and were ideated as being clean energy sources: *'hopeful to have more clean energy'*; though also not universally positive as when described as *'danger', 'hope/worry'.*

Whilst people were confident to voice fears, uncertainties, and resistances they were not defeated by them. Rather they were often able to integrate fears and uncertainties narratively with other more positive aspects (ibid). Containment in this context, can be understood as an ecology of objects that provide enough stability and safety to enable people to feel and cognize a range of positive and negative experiences including fears and anticipations related to the future (Rustin, 2012; Randall, 2012; Lertzman, 2012). More broadly across the data-set we learnt how concerns, fears and uncertainties were embedded into lived experiences and in relation to thinking through the impacts of the industrial vision plans. For example, one person wondered if prices would keep rising: '*Hopefully, they [local businesses] …. can afford the gas bills'*. Other concerns expressed related to health care and the environment: *'Do we really think that the green space is going by 2060?'* generating a response: *'With the amount the world's changed in two years, I've got no doubt that it probably will be gone'.* This last quote indicates, in line with the research hypothesis that people are living with the 'new normal of risk' (Greenberg and Lowrie, 2021; Pidgeon, 2014). Further the logic that, given the 'amount of change' further loss

of green space is entirely probable, illustrates how experiences of the new normal of risk informed the anticipation of future change. In sum the Port Talbot atmosphere of place reading provided both an overview of the affective ecology that related to local and global events, past as well as future hopes and fears, anchored through with stabilising objects reflecting a contained spectrum of experiences. Containment produces community resilience through the capacity to integrate hopes and fears with positive aspects within the infrastructural ecologies.

Wounded

The overarching finding from the Pembroke workshop visual tasks was the negative framing expressed and ideated in relation to much of the material infrastructure: the oil and gas refineries and the Pembroke Power-Station were typically ascribed with terms such as *'pollution'* '*eyesore' 'spoiled', 'vigilant', 'uneasy' 'fearful'* albeit with some more instrumental framed ascriptions either related to fossil fuel dependency *'need power', 'but I need it for my car'* or jobs *'employment important'*. In a similar trajectory much of the townscape areas were negatively ascribed on the mini icons as '*wasted space', 'lost generation', 'run down', 'congested'* or '*for tourists', 'touristy town hub'*. Milford Haven Marina, the Pembroke Dock Memorial Park, and the Pembroke high street icons attracted the most positive ascriptions generally in recognition of spaces that are good for socialising and having *'fun for everyone'*. However, the negative ascriptions were dominant denoting loss, wasted space or spaces only for tourists. In sum the visual tasks portrayed a wounded atmosphere of place. There was a lack of shared public objects (Honig, 2017), and instead shared expressions of rupture and loss. Following object relations theory we can see that 'goods' and 'bads' were not integrated and instead produced an uncontained and unstable infrastructural ecology.

Reading atmospheres of place in this multimodal way (images, words, registers) presents an opportunity to understand how townsfolk in each setting live with a range of cross-temporal experiences and ideations relating to their overall infrastructural ecologies. Seen through this lens it is possible to gain information about how some infrastructural ecologies embed psychosocial stabilisation (Richards, 2018), and invoke ideations of belonging and home with risks and uncertainties processed and managed. Moreover, reading atmospheres of place also identifies information about how objects may hold ruptures and wounds active in everyday engagements.
We were struck by the number of ascriptions that related to how things look. For example, spaces were frequently described as *'eyesore'* or *'looks untidy', 'ugly', 'good-invisible'*. Of course, it could be argued that in both workshops there was a focus on 'looking'. However, the Port Talbot ascriptions had little emphasis on how the things 'look'. Moreover, as we will explain, in its ruptured form the *looking* was as much about enacting a desire 'not to see' (Gugg, 2022), as a form of protection against engaging with the 'brute thingness of the photographs' (Rose, 2008). We return to the notion of the visible and invisible in section 3.3.

For the people in the Port Talbot workshop (at the time of the Research in August 2022) there were enough 'good' objects (Keene, 2012) to stabilise everyday life and enable articulation of both hopes and fears. However, the containing ecology was precarious, something denoted by evidence of splitting in the form of idealisation and a hard-won reparative reappraisal of the Association of British Ports vision for the docks area presented in the following sections (3.3,3.4). Pembroke was in contrast wounded, with fissures apparent between past and present industrial lineage, as well as other anchoring objects such as closed down high street shops, an abundance of disused and derelict maritime and navel buildings, and the loss of affordable housing, and health provision.

Fig. 4 'Wounded' Pembroke.[9]

3.2 The Least Uncertain Uncertainty and the Decarbonisation Vision–Plans

This section is organized with firstly a summary of concerns raised during the decarbonisation visions discussions, explaining the option of embracing least uncertain uncertainty. We then elucidate how living with risk framed the engagement with the visualisations (CGIs and infographics) that were analysed as signifiers of distances between industry, government and local people.

The industrial decarbonisation plans were presented during interactive PowerPoint discussions aligned to each workshop setting[10]. There was surprise when participants learnt about the extent of the South Wales Industrial Cluster vision plan, especially the introduction of hydrogen and carbon capture reuse and storage at the Port Talbot docks: *'And I didn't even know until I came here today there was a hydrogen research and production centre'*. We were asked about who was making the decisions and designing the visions, the role of UK and Welsh government, who would benefit and who would pay. People wanted to know if other areas of the UK and Europe had or will try similar technologies, or if Port Talbot is being used as a test site: *'So, basically, they want Port Talbot to be the pilot then'*. There was concern around the safety of the new technologies, and questions about how carbon can be captured and in what state both hydrogen and carbon could be transported. Although no one described the current Tata steelworks in terms of industrial risk (other than pollution; see Roberts et al., 2023) there was concern and belief that the proposed new technologies could be dangerous and present hazards. For example, in relation to hydrogen: *'The gas will kill you'*. On Carbon Capture: '*How safe will it be? What's the effect on the world around it…the marine environment…it's unbearable almost to consider'.* Dredging was also a lively concern due to [at the time] current news stories about the dredging in the Humber region and

[9] Top: Milford Haven, Pembroke Town, Harriet Smith; Below: Food Bank, Shutterstock; The Waterway, Aurora Imaging.
[10] The main visions plans we presented are mentioned in section 1.1 . See also Fig. 7

the claims by some groups there this had led to damaging impacts on shellfish and the environment there[11]. In Pembroke questions were raised about the impact of the freeport structure on local governance and service provisions. Overall, the participants' concerns align to understanding in risk theory that whilst known risks are often ignored, unknown risks receive differently weighted responses and cognitive and affective strategies (Slovic, 2000). We term this as opting for the least uncertain uncertainty, because of the relation between reduced concern towards familiar uncertainties and risks.

Given the intensity of fears, risks and uncertainties associated with climate change (alluded to in the workshops through concern for sea level rise and atmospheric pollution) as well as the workshop focus anticipating large scale industrial change and decarbonisation, it is not surprising that people might opt for familiar uncertainties and further take an idealising position. In section 3.3 that follows we expand upon idealisation strategies, demonstrating how initially the Port Talbot group embraced on-shore wind and solar as a preferable solution to industrial decarbonisation. Schulz and Zinn (2023) underscore how solutions to uncertainties and risks involve combinations of rational and emotion-based processes, especially where decisions and beliefs involve unclear and unknown information. Because specialised knowledge such as engineering is key to the development of the decarbonisation technologies, people have to rely on expert research portrayals of technologies for information (ibid, p.228). In Port Talbot proposals include the introduction of a hydrogen and captured carbon dock installation, and the proposal that the town steelworks could be powered through a combination of electrification, carbon capture, and hydrogen (fuel switching). Unknown risks invite stronger reliance on affective 'gut feelings', as well as hope and trust (ibid, Siegrist, 2021). Thus people will likely feel most safe to choose the option they have most information and understanding of and in the Port Talbot context initially it followed that on-shore wind turbines and solar were the least threatening proposals.

Living with Risk: Global and Local Interrelations

Global and local risks were entwined in participants' responses to industrial decarbonisation change. For example, during the discussion about options facing the future of the Port Talbot steelworks, one thread pondered the potential benefits of national fuel independence. The Ukraine war and recent fuel and food price rises had amplified and enlivened national security concerns as well as the relationships between global materials, power generation and manufacturing. One argument presented for continuing to make steel in Port Talbot [whatever the cost] was to not off-load carbon emitting industry to other nations. Discussions suggested people regarded themselves as global citizens with agency and collective responsibilities as well as local people thinking through the future of the steelworks, a signifier of home.

In Pembroke people had reasoned that it was because the oil and gas companies are global that they are not engaged with local Pembroke problems. The apparent lack of care was explained through concerns about potential gas explosions from storage sites: as one person stated, '*you only have to have a major explosion [for there to be] a major incident here*'. There was also a belief that in other places gas is not stored close to settlements: '*normally they are 30 miles away for that reason*.' Fears about industrial accidents were exacerbated by the closure of the Accident and Emergency unit at the South Pembrokeshire Hospital in Pembroke Dock. Whether the risks related to the refineries, other industrial installations or general health emergencies there was a consensus feeling that the townsfolk are uncared for and living without adequate infrastructure or protection.

> '*There is no infrastructure down here. There's no transport system. There's no health system. There's no -- the County Council don't give two flying whatsits about the county. There's nothing down here'.*

[11] For example here: https://www.bbc.co.uk/news/uk-england-tees-63478736

Relationships to material infrastructure curate encounters in space, and have experiential affects (Amin, 2014, p.149). The lack of health infrastructure both increased the risk of, and amplified fears in relation to, industrial incidents. The Pembroke infrastructural ecology reflected a contested relationship to global industries with an ongoing lively focus on localised risk. This makes sense because the Pembroke group were in a more precarious position (than the Port Talbot group) that extended temporally back to past industrial loss and forwards to potential new risks and uncertainties related to the Celtic Freeport. The quote also illustrates the distance between the material infrastructure regarded as wasted and lost and the stakeholder visions.

Reading Visualisations

Because new technologies rely more heavily on 'gut responses' it follows that understanding public responses to decarbonisation visualisations produced as communication devices requires critical attention to *how* responses are affectively invoked (Metze, 2020). The stakeholder visualisations need to be analysed as aesthetic objects that produced both anticipated and unanticipated responses (Crang, 2009). Participants considered whether the particular industrial visions presented in the workshop would materialise given past experience of visualisations promoted across the media.

Celtic Freeport Vision: Don't Trust Them.

One key vision in Pembroke is the Celtic Freeport[12] proposals. However, the ruptures from past industrial lineage, alongside memories of broken promises and lost jobs (Thomas et al., 2022), fed directly into a lack of trust regarding the notion that the Celtic Freeport might be a good thing. One participant, who worked in one of the renewable industries, tried to argue that jobs would indeed be created *'But it is a thousand more jobs for the area'*. But another retorted with *'Oh no, I understand the jobs, right. But they're only going to last till that's built'*. Others then joined in, and finally arguing that *'That's all American now anyway, isn't it: Valero....Chevron'* relating to the experience that the multinationals don't care *'They're all multinationals'*. This aligned with a larger conversation around the new proposals for decarbonisation and whether it would really mean new jobs for local people. *'Does the area see the benefit? Or is it the investors?'*. There was a resistance to giving up on the refineries: '*I think there's this common misconception that young people are sort of all for green technology'*.

One participant described the stakeholder visualisations as 'promises', which illustrates how people are affected through aesthetic portrayals of future plans: *'whether it's a vision or a promise or an idea .....there's nothing in place for it. There's no infrastructure in place for it.... nobody's talking to anybody'*. The quote illustrates how visions can be read as promises, which may become 'broken promises' if they do not materialise, feeding further into the breakdown of trust. People felt that the vision-makers had not grasped the wider context of a lack of local services and infrastructure required to deliver their plans. A gap was apparent between local knowledge and experience and the visualisations that presented the future without inclusion of past or future concerns. Whilst it may be counter intuitive to include problems within a visualisation it may increase credibility rather than be experienced as inauthentic.

Vision Fatigue

In Port Talbot, there had been a fair amount of media attention and public discussion surrounding visions for tidal infrastructure in Swansea Bay as a means of power generation as well as tourism (Roberts, 2019). Some participants marked onto maps a project called 'Blue Eden'[13] (a tidal lagoon development) instead of the SWIC and ABP visions we had presented, preferring one they had already read about and regarded as more beneficial:

[12] Celtic Freeport Milford Haven Port Authority https://www.mhpa.co.uk/our-services/celtic-freeport/
[13] Blue Eden: https://swanseabaynews.com/2022/08/25/swansea-renewable-energy-transport-hub-planned-as-part-of-blue-eden-project/
https://www.walesonline.co.uk/news/wales-news/swansea-council-blue-eden-lagoon-25956956

'What's it called? Tidal lagoon'....'They've been talking for years in Swansea'....'Yeah. And then the government said no'..... 'You know, it's ideal for a barrage'.....'Then it was yes. Then it wasn't. Then it was. Then it wasn't'.

This suggests that promotion through news outlets of unconfirmed plans as well as where plans are agreed but do not get built produces a sense of 'vision fatigue', with local people reluctant to engage after plans have not materialised. Promoting infrastructure visions that may or may not materialise through local news media and broadcasting can impact on the perceived reliability of 'experts' to actually deliver change in future (Pathak et al., 2022, p.127). Visualisations were situated by participants with other visions introduced across differing media overtime, rather than arriving as a new potential future into an otherwise passive ecology. Moreover, this aligns to accepting the least uncertain uncertainty in that people were invested in a previous vision they considered more familiar and less uncertain.

We have shown how the stakeholder visualisations enact as objects, freighted with political and wider cultural signifiers (whether intended or apparent to their creators). Moreover, the visualisations were engaged with by people in relation to their lived experiences of the infrastructural ecologies. The future risks were weighed up through multiple strategies involving both cognitive and affective processes. There is a link between distrust, vision fatigue and investing in caring about visions that may not happen, when there is an overall lived experience of things not working out in the past.

3.3 Evidence of Splitting

In this section we unpack how participants in both workshops processed change in relation to concerns within the infrastructural ecologies through psychosocial splitting. Understanding this processual mechanism elucidates how people later arrived at acceptances of the decarbonisation plans. Splitting occurs where individuals lack foundational stability to hold integrated positions, and thus where objects are ideated and experienced as either entirely good or entirely bad (Keene, 2012). The splitting psychic mechanism enacts in ways that ignore the inherent complexities involved in how objects are both 'goods' and 'bads' and moreover are entangled with other objects (infrastructural ecologies of both material and psychic objects). In this section we provide two examples of idealisation. Firstly, we explain how residents in Port Talbot formed an idealised position regarding on-shore wind and solar power as a solution to future energy requirements. Secondly, we provide an explanation of idealisation in the form of arguing that industry is essential. Attached to this example is a coping strategy involving the desire to make industrial objects invisible in Pembrokeshire.

The Idealising Constellation: On-Shore Wind and Solar with Wellbeing

One form of splitting is idealisation: 'The belief that something is 'all good' (idealization) is selectively emphasized in order to obliterate awareness of dangerous things' (Keene, 2012, p.167). We found that some participants formed an idealised vision of the future. Concerns that we summarise here as *food insecurity,* but which include wider deprivation uncertainties, were solved through an idealising future solution. A frequently selected image depicted a tray of food tins. Most ascriptions ideated the tray as a food bank referent, and provided ascription terms such as *'poverty', 'crisis', 'Government!'.* The food bank image was often positioned in relation to three other image icons depicting a sunflower, a garden, and a river during the constellation task. So this constellation identified food scarcity as a problem, and attached the sunflower/ garden/river images that in turn were often ascribed with concepts relating to happiness: *'Good', 'summer' 'happy times'* and nature and wellbeing: *'peace' 'better taste', 'nature-enjoyment', 'calm relaxing'*. Following the affective flow of relations

further we found that the food/wellbeing/nature constellation often assimilated with the on-shore wind and solar installation icon and articulated as a clean safe form of energy generation *'good-clean!', 'future', 'hopeful to have clean energy'*. In many ways this relational flow of objects is not surprising as it speaks to many current culture discourses on wellbeing, nature, and healthy food, which stands in opposition to food scarcity. Ideating on shore wind and solar as clean, safe energy is also in line with current cultural discourses promoted across media (Smith et al., forthcoming; Bressand and Ekins, 2021; O'Neill, 2019). It should be noted that the on-shore wind/ solar photograph was from a global picture library and did not originate in the UK. In this instance, the generic image opened up discussion of both the situated wind turbines on nearby hills and imaginary future ones (*'Well, this will become turbine central as well, effectively')*. Moreover, the image and the overall constellation also aligned with broader social wellness discourses present across many forms of media (Koinig and Diehl, 2021) illustrating one way in which ideated solutions included global media discourses as well as locally situated material affects. This exemplifies our proposition that understanding responses to change requires attention to enmeshed affective interconnections. The alignment of on-shore wind/solar with wellbeing as a vision to address food and deprivation is an idealisation discourse because it does not actually attend to concerns about food insecurity poverty and governance locally. More broadly, the constellation articulates on-shore wind /solar affectively as 'clean' energy without consideration of wider impacts such as the manufacture or material origins of the installations. Further, a lack of consideration to the scale of power supply requirements for industry as well as the impacts of industrial scale solar farms and on-shore turbines, suggests that this is an idealising solution. Through returning to the psychosocial logic we can see that the idealising position is problematic because it is unstable. As John Keene further elucidates 'This splitting into ideally good and bad 'persecutory figures'[14] is alluring because the illusory clarity it promises is much prized. It is, however, inherently unstable because only one bad element changes the ideally good into the unmitigated bad' (Keene, 2012, p.148).

Idealising Industry as Essential and the *Make it Invisible* Coping Strategy

In Pembroke for many industry was ideated as essential. We argue this is also a form of idealisational splitting because industry was articulated as essential despite evidence of the problems caused by living alongside the oil and gas installations, such as loss of access to spaces and both on and off shore, pollution, and fears as well as direct experience of industrial accidents. Alongside an apprehensive sense of uncertainty went a feeling that without Valero there would be catastrophe: '*You know, if that did go, that would be like a hammer blow, and that would have like ripple effects not just for jobs but for like housing, services….it would just be catastrophic really….And then just the estuary as a whole'*. This belief was a strong thread running through the workshop, and the quote suggests that the belief in reliance upon Valero (and the other companies) stretched beyond the towns to the 'estuary as a whole'. Without jobs people would have to leave the area, and so they felt completely dependent on the oil and gas companies. Overall we considered the infrastructural ecology to be one of loss, where people considered their localities to be a sacrifice zone. Idealising industry as essential provides a logic to explain how to keep going with experiences of wounding and loss. Moreover tied to the idealisation of industry as essential we found a denial coping mechanism evident across all types of objects, which entailed a desire to make problematic things invisible, to hide objects or less intensely to cast them away ideated as eyesores and wasted spaces.

[14] Keene's illustration enforces the idea that through proposing on-shore wind and solar as a solution for industrial power supply an 'illusory clarity' is constructed. We cannot however go as far as to determine that other forms of decarbonisation technologies, or existing fossil fuel emissions from the steelworks, were ideated as persecutory. That said if the on-shore wind idealisation were to materialise it could unfold as a dynamic of further splitting.

In Pembroke we found a 'hidden objects' strategy, combined with a desire to make things invisible as a mechanism to manage frequent articulation of how things were 'eyesores', 'wasted space', 'lost generation' 'for tourists'. Some workshop participants chose to physically hide the Valero refinery and the Pembroke NetZero Centre mini icons underneath other icons in their constellations. As Knox explains: "attention to these embodied, affective engagements with infrastructure allows us to unpack something of the unstable ..... projected forward into forms of pressure, resistance, and a calling forth of a response from the powers that be." (Knox 2017, p.368). The focus on how things look was part of a strategy of wanting to hide things that enact affective registers to past rupture and loss (Gugg, 2022). Gugg has argued that making things invisible functions as a form of coping defence mechanism, enabling denial of what is unbearable (ibid). In this way the act of hiding is regarded as a good thing. During the Pembroke workshop we heard about the hospital closure, the loss of past ship building and fishing industries, the closure of shops in the high street, and the impact of Airbnb and broader tourism on local people. The emphasis on seen and unseen eyesores and invisibility can be understood as a response to feeling uncared for, yet dependant on the global energy companies – something seemingly both unbearable and inevitable.

A further way that 'seeing' enacted as a coping strategy was evident in positive ascriptions. Rather than engage with the images through their 'brute- thingness' (Rose, 2008), for some, there was a need to maintain a safe distance - to not 'be affected'. The icon photograph for Milford Haven Waterway was an aerial shot[15] depicting the blue estuary, almost animate winding out to sea, with the land either side dominated by industrial installations. The waterway ascriptions sat between ideating a vision of pollution, or industry, and landscape expressed in poetic experiential framing: *'future-time' 'calmness' 'beautiful by night'*. So where positive, the ascriptions did not connect to anchoring community experiences, but rather related to dreamscapes. From a psychosocial perspective this can be explained as a coping strategy (Gugg, 2022) involving a disassociation from visceral engagement with the material-thingness of the industrial installations towards dream-like ideations. In contrast, thinking about the Port Talbot steelworks night-time photograph with twinkly lights[16] one can see how that image could have invited similar poetic responses but instead attendees ascribed it with *'means I'm home', 'heart of Port Talbot',* demonstrating a relation of anchoring into the grounded materiality of the infrastructure. The scenic Pembroke ascriptions instead draw outwards away from the materiality of the infrastructure towards a poetic of dreaming (Larkin, 2013). Furthermore ascriptions of industry as 'beautiful by night' provide a means of coping through a disavowal of pollution and spoiled ground and air (Weintrobe, 2012, p.72). Weintrobe explains "disavowal involves radical splitting and a range of strategies that ensure that reality can be seen and not seen at one and the same time" (ibid). This form of coping strategy, she argues, differs from denying something, which can lead towards facing up to what is difficult. Disavowal can instead escalate (ibid), developing from a deep-rooted disillusion that is more difficult to overcome. Here it involves splitting away the daylight version of the industrial installations (experienced as dominating socio-material life, producing economic dependence, pollution and land degradations) and shifting over to the poetic version of the infrastructures as beautiful by night.

[15] See Fig. 4 - Milford Haven Waterway image is bottom right
[16] Port Talbot Twinkly lights, See Fig. 8 bottom right.

3.4 Forms of Acceptances

Achieving understanding of acceptance requires analysis of mechanisms involved in articulations of hope and idealisation and reparative strategies. In this section we firstly explain how the Pembroke group embraced the plans for off-shore wind, despite having deep concerns and fears. We then close with an explanation of how the Port Talbot group re-purposed the ABP vision to make it a more inclusive and acceptable vision of the future for them.

The Embrace of Off-Shore Wind

In many ways there is enough evidence to explain why people in Pembroke were lacking enthusiasm and trust in relation to the decarbonisation vision proposals (see sections 3.1-3.3) because there appeared to be difficult circumstances in every direction. The infrastructural ecologies portrayed living with risk, loss, and distrust in (global and local) others, that cumulatively can be understood as a 'sacrifice zone' (Brock et al., 2021; Thomas et al., 2022), where everything is lost or under threat from outside interests. Further we have shown how a range of coping mechanisms including denial and forms of 'not seeing' emerged in the workshop. There is an irony here in that it is the infrastructural wounding and coping strategies that made the decarbonisation proposals acceptable rather than an integrated form of reparative acceptance. So rather than achieving just transitions, here on offer is a transition that gains acceptance through capitalising on psychic coping mechanisms such as 'not seeing'. But on a more positive note, there are clues as to how trust and hope could be materially built into the decarbonisation pathways through taking reparative steps. Attention to existing and future local material infrastructure, and making good on perceived or otherwise broken promises, could lay the ground-work for developing trust and stability.

The embrace of the Celtic Freeport off-shore wind farms proposal was aligned to the coping defence mechanisms involving the selective poetic seeing and the making things invisible disavowal strategies as discussed above in section 3:3. What made the proposal acceptable was its perceived invisibility, something regarded as a positive reason to embrace this form of installation:

> *'I think people will be happier that the fact that it's, like you say, 40 kilometres or 40 miles into the sea, where it ain't an eyesore. I mean, ... What you can't see, you don't think about sort of thing... So I think that going into the water is a bonus for that kind of scenario, you know'.*

The logic of making things invisible works in the same way as choosing only to see industry as *'beautiful by night'* because both strategies ignore or 'turn a blind eye' to what is unbearable (Gugg, 2022). A minority did want to embrace the new technologies, some arguing that because there would have to be infrastructural improvements to transport, health and housing in order for the construction of the installations to be feasible it would be worth the changes. But overall what held the people together (Richards, 2018; Walkerdine and Jimenez, 2012) were the shared coping practices, evidenced by the identification of eyesores (bad objects) and the hope that bad objects might in turn be invisible. These people managed the unbearable through a hope of things being hidden and through a form of splitting away that involved removing themselves from the material infrastructure and only engaging with it as dream or eyesore. This form of containment strategy rather than providing stability and the possibility of integration, instead produces instability (Keene, 2012) and leads potentially towards disillusion (Weintrobe, 2012).

Port Talbot Super-Town: Reaching a Reparative Position

Thus far we have shown how the people in the Port Talbot workshop initially embraced an idealising solution utilising on-shore wind and solar (3.3) and how they also stated a preference for the Blue Eden vision (p.14) that was not part of the stakeholder visions we had introduced through the workshop. We have also explicated how concerns were discussed in relation to the steelworks' future. As the workshop progressed the discussion threads came together in an agreement that any Port Talbot decarbonisation change pathway should '*Make it a proper Super-Town*'. This position succeeded because there was a recognition that for the steelworks to have a future it needed to eventually cease its emissions. The Association of British Ports (ABP) vision involves the development of the dock area for hydrogen and captured carbon transport that were initially met with resistance (in favour of tidal energy generation), but that gave way when configured with the wider idealising positions making other wanted or known aspects possible - such as local economic growth and more healthy lifestyles. Earlier we argued that to use on-shore wind and solar as a solution to industrial decarbonisation did not engage with the scale of energy required and was thus an idealising position. Accepting the hydrogen and carbon capture proposals involved an integration of goods (clean living, prosperity) with bads (fears about unknown technologies and marine pollution).

The ABP development plan for the docks portrays a vision of a Super-Place transformed and ready for the next generation of re-industrialised economy (Business, Energy and Industrial Strategy, 2020). However, the participants were quick to notice a lack of attention to the prosperity and transformation of civic areas of their town. From a resilient and contained community position the group embraced the ABP vision conditionally via an appropriation and repurposing of the concept of Super-Place to fully include the town. Thus they re-purposed the term Super-Place to 'Super-Town': '*Yeah. That would be like a Super-Town then, wouldn't it*'. The idealising vision that earlier was dependent on utilising on-shore wind and solar, was reformulated when the inclusion of the steelworks was re-envisioned as clean:*' Cause they go together, and that could be an answer for lower emissions in the future'.* Even those who had wanted it to close now agreed it should stay if it stopped polluting. It was understood that the current proposed ABP vision plan presented that opportunity - albeit with the contingent demand that the developments included improvements across the townscape.

We were interested to observe how participants' ideation of solar and wind energies - as clean and green - engendered responses to the newer technologies of blue and green hydrogen and carbon capture and the carbon capture reuse and storage combinations proposed by the SWIC and ABP plans. It has been recognised that there is a danger of idealising renewable energies (Devine-Wright, 2022), and that this question of risk is closely aligned to concerns about how energy companies may be greenwashing (Bressand and Ekins, 2021; O'Neill, 2019). Through the successful embrace of 'clean' solutions to fossil fuel emissions, there is concern that newer technologies aiming to tackle climate change may be less popular (Bressand and Ekins, 2021). However, in Port Talbot we found that on-shore solar and wind enacted more as 'gateway technologies' to the less known and understood newer proposals. Although concerns were initially articulated through risk and uncertainty discourses, the idealising constellation that incorporated addressing food insecurity became connected to the ABP vision – contingently if there were wider civic benefits. In order to come to a position on the new energy technologies - where there is uncertainty, and a lack of knowledge - trust and reparation were key strategies (Otto et al., 2022; Siegrist, 2021). The townsfolks' perspective and sense of agency in relation to global matters extended in their vision to become a Super-Place *'Because it would be in the eyes of every country in the world as something to emulate'.* This last position was arrived at because the overall infrastructure provided enough stability for attendees to reach a contained position integrating and weighing good and bad aspects to produce a possible future for their town.

4.Final Thoughts: psychosocial engagements and infrastructural ecologies.

We have provided an explanation of noticeably different responses to decarbonisation of industry plans within two local infrastructural ecologies (Port Talbot and Pembroke Dock), exploring how both global and local objects are entwined in ways that impact on people's lives. Our analysis has demonstrated that surface acceptance of new technologies is not enough to guarantee positive responses to social change and moreover does not necessarily support the goals of just transitions. We have argued that during this time of the new normal of risk more is required in order to understand public responses to future change pathways.

This report offers opportunities for policy and industry to co-construct change pathways through attending to how visions are received by local people. The report usefully explores how expert visions can land as outsider perspectives through aesthetic signifiers, and further how visions that do not manifest can erode trust and engagement with plans for change. More positively our research offers clear pointers to how making good on past wounds could conversely build trust and stability, materialising productive actions for local people. Through the frame of infrastructural ecologies, we have opened up the terrain of place through addressing multi-scalar socio-material objects involved in sense-making. We have presented psychosocial analysis to explain resilience and acceptance as complex constructs.

Explanations of some of the obstacles to change include resistances wrought through denial strategies, in turn developed to manage past experiences. Potential solutions to precarity and resistances could be through developing industrial pathways with awareness of wider ecologies and lively objects. Community containment is constructed through a complex range of local and global ecology objects leading to resilience and the ability to integrate 'goods' and 'bads'. We argue that a pathway to achieving just transitions is through attention to making good (at least good enough) objects to build trust and contained ecologies.

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Appendices

Appendix A: Research Design

Deliberative workshops enable people to spend concentrated time *deliberating* potential pathways for change, situated within their group localised experiences and knowledge. Public engagement aims to engender discussion that enables citizens to frame and decide the key issues involved themselves, rather than respond simply to pre-determined 'expert' narratives and frames (Pidgeon, 2021; Pidgeon and Rogers-Hayden, 2007). Commonly deliberative workshops are designed so that participants can imagine and then consider what is unknown about environmental, social legal and ethical aspects of technical applications of scientific knowledge and its wider impacts. We constructed the research design to gather affective, emotional, and cognitive engagements with relevant objects, anticipating that this would enable us to discover what the active lively objects were in the participants' affective infrastructural ecologies (Davies, 2014; Larkin, 2013; Latour, 2004).

Both workshops had fifteen participants who were recruited to reflect the socio-demographic makeup of the area in relation to gender, race, religion, profession, age, and interests. Genuine 'representativeness' is of course impossible to achieve given our small cohort and the fact that each participant holds more than one category. The two workshop groups were fairly similar in demographic range and during the workshops there were clear 'stereotype voices' that mirrored one another between groups. Hence, in each group there were a small number of people who worked in relevant industries, some retired people, and some young adults starting out in life. In both groups we ensured that participants lived or worked locally, and with some having strong family ties over generations to the area.

Workshop Tasks

Task	Description	Data type
1.Individual Mapping: 2 x A3 maps of local area past and present	Annotate routes, attachments, import of past-desires loss /retain 'what must stay', 'what can be let go'	Ice-breaker. Locating infrastructural ecologies / relation to material spaces and to changes over time
2.PowerPoint- Stakeholder Visions Information & Discussion	Decarbonisation stakeholder visions, media reports	Discussion /responses
3.Future Map: 2060 size A0 groups of 5	Annotate / imagine area 10 years after NetZero 2050	Extended responses to vision-plans in relation to future mapping
4.'Mini Icons' pack of images- new technologies, industry, town objects, past / present	Individual ascriptions of mini icon images: ascribe 1) definition,2) meaning, and 3) feeling	Affective responses and personal themes emerge through ideations, emotions and affective expressions
5.Constellation– most meaningful mini icons	Position meaningful images, annotate relations between objects	Ecology with objects & themes evident as Affective Flow constellations
6.Return to the Future Maps in group	Discuss the future, add in most meaningful mini icons annotations	Deepening into plans after engagement images/personal situated values
7.Discussion	Open discussion aligned to themes that emerge over day	Generative data for interpretation

Fig. 5 Workshop Task Table.

Fig. 6 Composite: Workshop Tasks.

Fig. 7 Composite Stakeholder Visions.[17]

[17] Top row: SWIC, RSPB, RWE, Shutterstock. Below: 'Save Our Steel' Common Wealth Theatre, Shutterstock, RWE

Fig. 8 Example Mini Icons from both workshops.[18]

The mini icon task (Fig. 5, tasks 4,5, and 6) involved using packs of 'mini icon' photographs. We produced a range of photographs many made by the team walking around the local area attending to different types of objects (industrial, leisure, amenity, civic, etc.) with the aim to evoke different forms of everyday meanings and use (temporal signifiers, activities etc.). Firstly, individuals worked through their pack, ascribing each image with a definition of what was depicted, the image meaning, and associated feeling invoked. Next, participants were asked to select the most meaningful cards for them. Lastly, they were positioned selected meaningful photographs into a constellation with annotations to explain the interrelations. The images could be read both generally or personally as image-object representations of cultural phenomena and/ or representations of material fabric. Photographs also enacted affectively through their 'brute thing-ness' (Rose, 2008). So, the images operated within multiple affective and cognitive registers. Further, bringing together image and ascriptions reflexively and dynamically offered ways of attending to multiple, situating aspects rather than imposing totalising narratives.

[18] Tata Steelworks, Port Talbot; Audi taxi, Pembroke town and castle; Valero Refinery Pembroke; Milford Haven fishing vessel; Sunflower; Aberavon beach; Pembroke Dock road; River, all Harriet Smith. Motorway lights; Hydrogen tanker ship; Food bank; On-shore wind and solar; Washing line; Food bank; Tata Steelworks at night, all Shutterstock. Off-shore turbine maintenance, Blue Gem Wind; Graving Pond. Pembroke Dock, Adrian James; Chapel, Oliver, Paul, Creative Commons ; Memorial Park, Pembroke Dock, Jaggery, Creative Commons.

Appendix B: Analysis

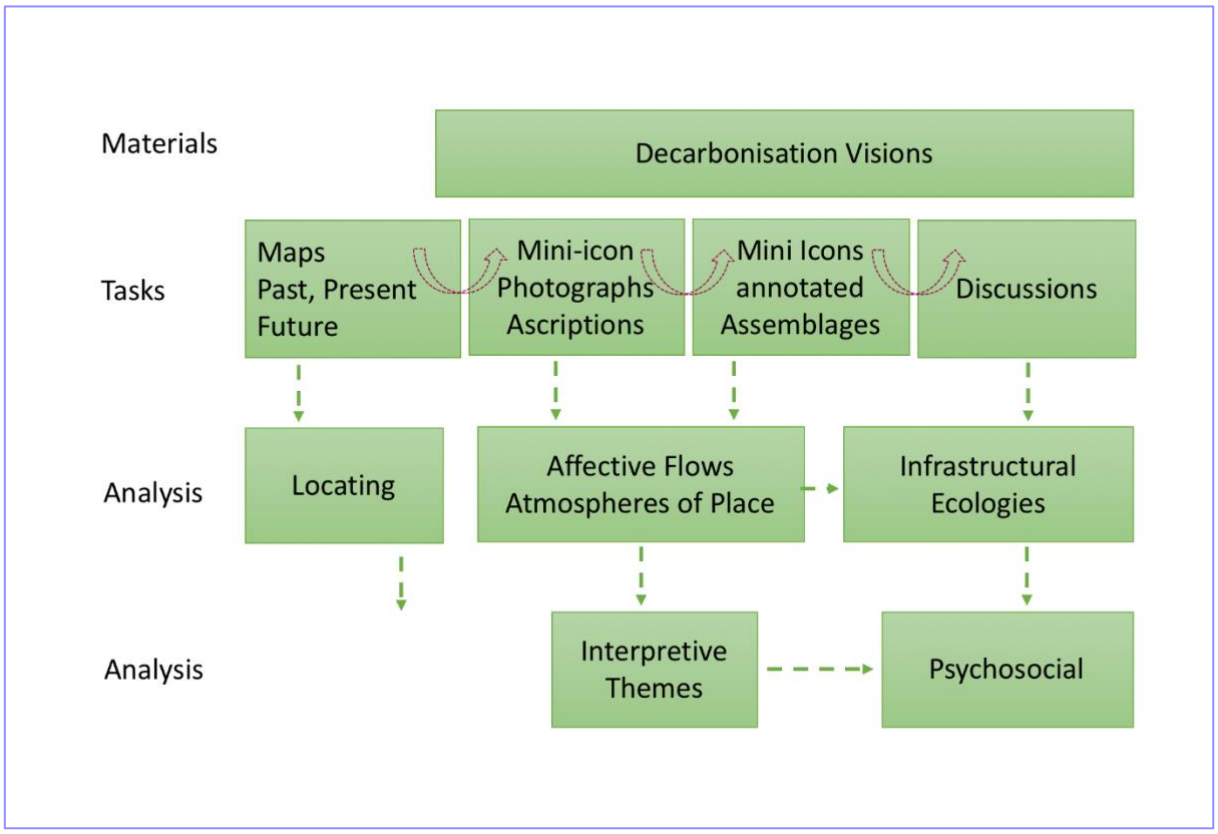

Fig. 9 Data Flow Diagram.

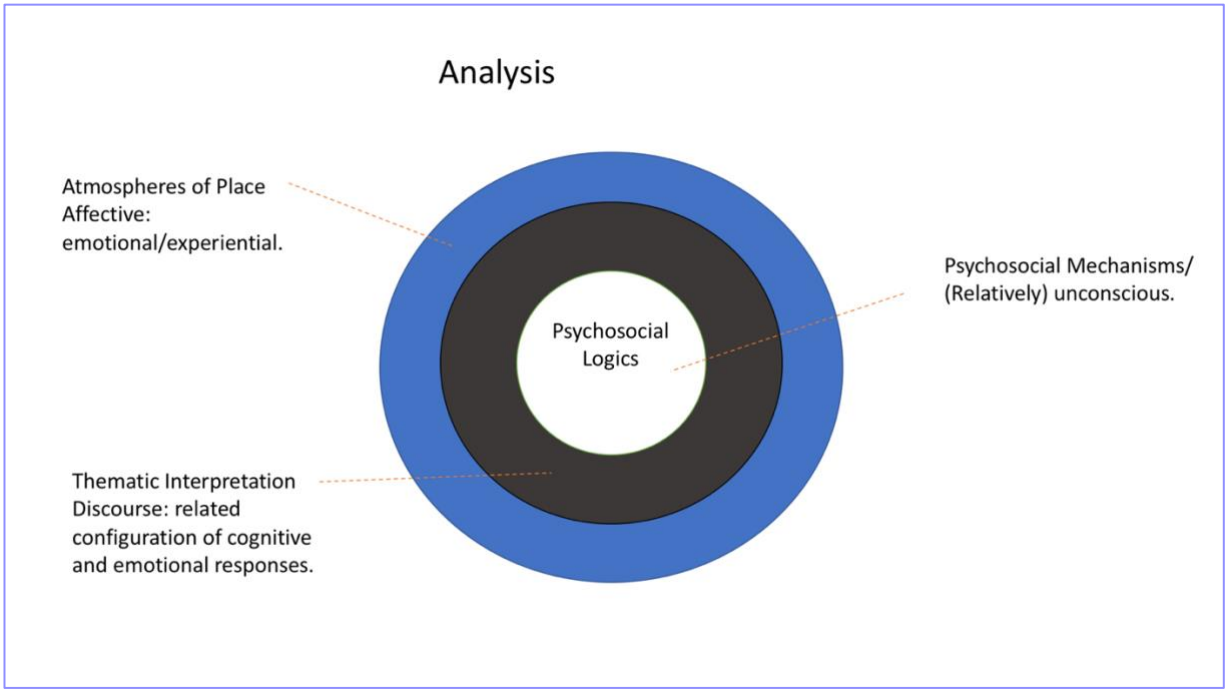

Fig. 10 Analysis Diagram.

Initially we organised the data and conducted a holistic analysis, through constructing affective flows read as 'atmospheres of place' (Amin, 2014). We noted firstly what intensities were ascribed to the mini-icon images (read by participants through their 'brute thing-ness': Rose, 2008, also Latham and McCormack, 2009), and secondly which icons were selected as 'meaningful'. The latter were then added into the following tasks (tasks 5,6, Fig. 5).

The constellation task data was approached as flows of relations between objects. In some cases people also added in new objects, or redefined objects. In this way the images provoked affects that could not have been anticipated. The analysis had to take into account the ascriptions in each individual's data-set in order to decide what registers were active and how. The task processes foregrounded how people navigate their lives, as constellations of relations between internal and external material and psychically coded objects.

To further interpret the data we identified what beliefs were consistently returned to in order to understand what objects in the ecologies invoked shared affective experiences and to gather recurring themes. Themes were apparent during both the ascription and discussion tasks across the day. Following the affective flows of the mini-icons provided a layer of intensity (atmosphere of place) and also produced data that originated from a more internalised experience than the discussion data that had inevitably been cognitively processed into publicly shared verbal discourse.

Lastly, we re-worked the analysis to develop psychosocial understanding of mechanisms that were active in how decisions were arrived at. Thus the layered portrayals of the infrastructural ecology themes and processes involved how participants engaged with the decarbonisation visions, and provided multimodal data that we utilised to produce psychosocially informed analytic findings.