Re-thinking transformative visitor experience in a science exhibition

Implications for science communication theory and practice

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‘Writing isn’t so bad really when you get through the worry. Forget about the worry, just press on…’ Douglas Adams

Abstract

Science communication addresses some of the contemporary world's most challenging and intractable problems. Whether climate change or the recent coronavirus pandemic, science communication has an important role to play in these urgent issues. Concurrently, language around 'transformation' is increasingly used to suggest the kinds of profound changes to individuals and society needed to address contemporary problems. Science communication practice strongly values changing its publics in one way or another, be that their attitudes, values, or behaviour. But the language of transformation suggests a more profound change; what does it mean to be transformed?

Taking a new exhibition, *Invisible Worlds*, at the Eden Project, a visitor attraction in South West of England, as an example, this thesis examines how we might conceptualise transformation in a science communication context. By combining action research and grounded theory methodologies, it has been possible to gain an understanding of both the exhibition's development, as well as the transformative experience of visitors. Interviews, observation and reflective discussion with staff, alongside documentary evidence, traced the development of the exhibition while photo-elicitation interviews with visitors gave insight into their embodied experience.

Two central theoretical categories were developed from the grounded theory analysis. Firstly, negotiating ambition describes a process of institutional maintenance which frames science communication projects as highly ambitious. Within this context, transformation can be interpreted as a discourse used to maintain an ambitious framing. Secondly, serendipitous wandering is the process through which visitors to *Invisible Worlds* attempted to build an understanding of the exhibition. In some cases of this serendipitous and embodied process, visitors were able to make deeper meaning, which supported and was integrated into existing life developments.

The findings of this thesis suggest need to re-think transformation as both a discourse and phenomenon in science communication. Rather than provoking

transformative change, it is suggested that science communication might be well-positioned to support publics through life in a changing world.

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1 Introduction

The modern world is pervaded by so-called wicked problems (Dillon et al., 2016) – intractable issues such as climate change and social injustice where there is no agreement about solutions and our attempts can seem to generate more problems than they solve. Most recently, the COVID-19 pandemic has presented itself as one such problem which has drastically impacted every aspect of social life, and which is intimately entwined with science. It has become common to hear the language of transformation surrounding these issues – the idea that radical change is needed to overcome them. But what does it mean to be transformed? How can and should science communication respond? Answering these questions has become increasingly urgent as recent developments have seen the rejection of experts and declarations of a 'post-truth' world (Sismondo, 2017). These current challenges spread much wider than historical single-topic issues such as nuclear power or BSE (Sturgis and Allum, 2004) and have been made even more acute as the pandemic has spurred on effective anti-science movements (Schradie, 2020).

At the same time, in recent decades, we have seen the failure of the traditional information-based approach to science communication practice which has now long been discredited and fallen out of popularity (Bauer, Allum and Miller, 2007; Sturgis and Allum, 2004). Nevertheless, this mode of practice at least tacitly continues to dominate contemporary science communication (Besley and Tanner, 2011; Meyer, 2016; Simis et al., 2016). Moreover, science communication has become more professionalised (Bevan and Xanthoudaki, 2008; Uyen Tran and King, 2007), and there is continued debate about what science communication as a profession could actually be, as seen in recent professionalization scoping exercises (Featherstone, 2017). Science communication practitioners are little aware of the academic discourse on and critique of science communication practice (Falk et al., 2012), and although in recent years efforts have been made to translate research for practitioners (see for example informalscience.org), there is still a large gap between research and practice, which may hinder the innovation of new approaches.

This thesis goes some way towards addressing the issues surrounding the urgency of science communication. Working closely in collaboration with the Eden Project, a botanic garden and visitor attraction in the South West of England, this thesis puts forward an approach at bridging research and practice by combining action research and grounded theory methodologies to explore the production of a new science exhibition. By taking the concept of transformation as its starting point, this thesis explores how science communication might support transformative change in a changing world.

1.1 The Eden Project in context

The Eden Project is a botanic garden and visitor attraction in Cornwall, United Kingdom, which comprises tropical and temperate greenhouses as well as extensive outdoor gardens. The site, which is housed in a disused China clay pit, receives around one million visitors a year, and offers a unique educational experience which aims to connect 'us with each other and the living world … through the power of transformation' (Eden Project, 2016). The Eden Project was opened in 2001 as one of the visitor attractions funded by the Millennium Commission. At the time, the Millennium Commission funded the development of several science centres as part of larger regeneration projects, and while the Eden Project is not strictly a science centre, it retains membership to the UK Association of Science and Discovery Centres (ASDC). As such, the Eden Project can be seen as part of the UK science centre movement which received a significant boost around the turn of the millennium, at the same time as discussion in science communication was hinting at a 'new mood for dialogue' (House of Lords, 2000).

While the Millennium Commission provided funding for the first three years of operation, now, the Eden Project relies largely on ticket sales to maintain its operations and is therefore heavily invested in attracting more visitors. Similar to other comparable attractions, one strategy for attracting new visitors is developing new exhibitions. The exhibition, *Invisible Worlds*, explored in this thesis, is one such example. The Eden Project sought funding to redevelop The Core (Figure 1), which had opened in 2006, to attract more visitors to this relatively unfrequented area of

the site. Based on the success of their exhibition about the human microbiome, *Invisible You*, Wellcome awarded the Eden Project funding in 2016 to renovate the building and design a new exhibition and programme, *Invisible Worlds*.

Figure 1 Foreground. The Core building exterior. Photo credit: Eden Project.

Figure 2 The Core atrium, before the installation of Invisible Worlds. Photo credit: Eden Project.

The exhibition explores interconnected planetary phenomena too small, too large, too quick or too slow to comprehend (Eden Project, 2016) – the interface between microbiology and earth systems science. Visitors enter the exhibition through a selection of three 'gateway' exhibits, interactive installations which explore different dimensions of the exhibition content - the vast, the microscopic, and deep time. On passing through the gateways, visitors enter the main atrium of the building (Figure 2), where a centrepiece sculpture, *Infinity Blue*, draws together the gateway themes. Supporting the exhibition are satellite exhibits across the Eden Project site, as well as temporary exhibitions and a programme of live events.

This subject area of the exhibition is difficult to address because visitors may hold common misconceptions (Francek, 2013), and the complexity of systems thinking (Stillings, 2012) and scales (Tretter, Jones and Minogue, 2006) involved are challenging. Nevertheless, *Invisible Worlds* has ambitious aims of challenging visitors' attitudes, beliefs and behaviours. This PhD project followed the development of *Invisible Worlds*, unpicking the exhibition's aim to 'transform peoples' thinking of how they see the world' (Eden Project 2017, personal communication) to understand what transformation means, or could mean in this context.

Transformation, then, forms the central sensitizing concept of the thesis, being the conceptual starting point from which the empirical exploration developed. The selection of transformation in particular, as opposed to either more generic or specific forms of change, was made for several reasons. Firstly, the language of transformation appears frequently in the Eden Project's marketing materials and internal ways of talking about the attraction, from the tag line "transformation, it's in our nature", to the more specific aim of transforming how visitors see the world. It is not an overstatement to say that transformation, however defined, sits at the core of how the Eden Project identifies itself as an institution. Nevertheless, this notion of transformation remains loosely specified – even looking at the phrase, "transformation, it's in our nature", we can see a multiplicity of implied meaning. Transformation permeates across the physical transformation of the Eden Project site from a China clay pit to a visitor attraction, the individual transformations of visitors'

worldviews, and the broader sociotechnical transformations needed to actualise the Eden Project's vision of working in connection with one another and with nature.

Within this multiplicity of understandings of what transformation could mean, the present research zooms in to look at transformation on the micro-social scale. This focus, influenced by the consensus of Eden Project staff resulting from the Delphi process outlined in subsequent chapters, aims to explore the processes of individual transformation which may intersect with a visit to *Invisible Worlds*, as well as the institutional processes which may create the conditions for such transformations to occur (i.e. the exhibition development). It is important to remember that transformation is a sensitizing concept, the starting point of the research journey. This exploratory, inductive journey traces a path which winds in many directions, touching on concepts as varied as serendipity, embodiment, institutional maintenance and legitimation. Sometimes transformation is front and centre in this exploration, filling the foreground. At other times, it lurks as a backdrop to other ideas. Transformation nevertheless is a concept to which the discussion always returns. Beyond its contextual relevance to the Eden Project in particular, the commitment to focus on this form of transformation arises from its wider relevance to science communication in general, as a non-normative change which obviates knowledge transfer (Mezirow, 2009), challenging traditional thinking about science communication.

At this point of the thesis, it would be remiss not to mention that the PhD was funded through a joint studenship from the University of the West of England and the Eden Project. While the PhD was partly funded by the Eden Project, there was no commitment to representing the Eden Project in a particular light. As a researcher, I have attempted to present an open, honest, and most importantly fair and useful account of what happened, whilst respecting the confidentiality of both the Eden project staff as well as the Eden Project as an institution. What is presented in this thesis is a necessarily selective account - with such an unusually permissive level of access to the exhibition development process there is also a degree of compromise. Staff were aware I was recording information and where it was indicated to me that something was "out of bounds" I respected that boundary. Equally, I have been

careful throughout the research process, as well as in the thesis itself not to make any value judgements about *Invisible Worlds* or its development process. Where success or otherwise is discussed, it is always in reference to how the Eden team themselves described the outcomes of their efforts. True to action research – an account which reflects the interests of the group in a way which is useful to them. The aim through this thesis is to provide a rich enough description that the reader might judge for themselves to what extent the concepts developed from the research are convincing, useful for reflection and application.

1.2 The researcher in context

Situating myself within the thesis is not meant to unduly draw attention to myself, but, as part of a commitment to reflexivity, is meant to acknowledge that the work presented in the thesis, interpretations and findings, are told in my 'voice'. My interpretation unavoidably comes from a certain perspective and point of view. That is not to say that the findings presented in this thesis are biased, and much effort has gone into ensuring the quality of the findings, but that subscribing to a constructivist epistemology (detailed in Chapter 3) means appreciating that the research process is necessarily interpretive. Where appropriate, I have used the first person throughout the thesis to make the process of interpretation more visible. While more detail about the philosophical underpinnings of the thesis and how these have been applied in the research are given in later chapters to ensure trustworthiness and transparency, in this section I outline a little of my professional background so that the reader can gain some insight into how it may have guided the philosophical position of the thesis.

I started working in science communication as a teenager, at a small, local science centre as an Explainer, someone who explains exhibits to visitors. At that time, I had a strong interest in science and was enthusiastic to share it with others. It was this enthusiasm which motivated me to continue working in science communication after graduating from my undergraduate degree in chemistry, again as an Explainer, this time in a much larger science centre. Through this work, I developed my science

communication practice, eventually moving into other roles including programming and audience research.

Alongside developing my science communication practice, I studied for an MSc in science communication at the University of the West of England. Through the programme, I started to become more critical of science communication, and discovered new ideas about how people learned in science centres and museums. I was particularly influenced at the time by Falk's and Dierking's contextual model of learning (Falk and Dierking, 2013), as well as constructivist learning theories more generally (Illeris, 2009). I began experimenting with applying these ideas in my own practice. At the same time, I started to become interested in ideas around reflective practice (Argyris and Schön, 1974; Schön, 1991) and similarly, started modifying training I was delivering to incorporate principles of reflection.

Despite these developments in my practice, after some time I felt that what I was doing was not enough. I became frustrated by what seemed to be an insurmountable gap between research and practice, particularly lamenting how slow practice was to apply ideas from science communication research. Discussions with colleagues about reinventing the wheel reflected academic discussions about reproduction of the deficit model (Simis et al., 2016). At the same time, I was disappointed by what I considered to be poor quality (particularly qualitative) audience research and evaluation in the field (Jensen, 2014) which did little to give audiences a voice at the table. Entering the PhD, I saw an opportunity to address these issues.

Coming in to the field at the Eden Project, there was a fairly rare opportunity to get a close insight into exhibition development, working with the exhibition team on a personal level not often afforded to other projects. At the outset, while having worked in the science centre world for some time, I had not worked with the Eden Project before, and it was challenging to establish a connection with the team. Their informal and spontaneous way of working in a busy, operational environment butted up against the structured requirements of academia. Being strongly invested in improving science communication practice myself, I had not anticipated how challenging it would be to establish buy-in for the research, and the level of

collaboration required for an action research project. Geographical separation also proved at times problematic in that while for me, it was a significant undertaking travelling to the Eden Project site, for the rest of the team it was just another day where, understandably, my research rarely featured high up the priority list. Mentioning these issues is not meant to complain in any way, but to highlight the significant practical implications in bridging research and practice, where differing priorities, timescales and ways of working can butt up against each other. Throughout the process, I adapted my research methods, sometimes opportunistically, to capture what was going on in ways which worked around what was happening with the team at the time – a process which I describe in more detail in the respective methods chapters. The experience of the PhD has been an incredibly personal journey. It is not without some sense of irony in a thesis about transformation to say that the PhD process has changed me and my views in many ways. Not least, the PhD has formed part of a process going from an undergraduate degree in chemistry to a PhD closely allied to the social sciences. Many of the ideas presented in this thesis, particularly relating to methodology, have been hard-won from this quite radical shift from the objective scientist to the subjective qualitative researcher.

As a science communicator and now as a researcher, I am driven by a strong commitment to improving practice. This thesis represents part of that commitment – an experiment in seeing how research and practice might work more productively together.

1.3 Thesis overview

The thesis covers two interrelated pieces of work which together form an action research project carried out in collaboration with the exhibition team at the Eden Project. In the next chapter, relevant science communication literature is reviewed, with a view to introducing important sensitizing concepts at the outset of the study such as transformation, identity, materiality, relationships, social interaction, practice, process, emotion, and narrative. Chapter 3, drawing on ideas of liquid modernity, pragmatism and transformative learning, discusses the theoretical and philosophical

underpinnings of the thesis, and justifies methodological choices made throughout the research process. Action research and grounded theory methodologies are outlined, as well as my approach to their combination.

Following the methodological discussion, the next few chapters give details about the two major empirical pieces of work of the thesis. For clarity, the description of methods and results is separated into two strands which are presented sequentially in Chapters 4 and 5, and 6 and 7 respectively. Firstly, Chapter 4 outlines the methods, as part of the action research process, used to generate data about the production of *Invisible Worlds* from an organisational perspective, including a Delphi process, interviews and reflective group discussions with Eden Project staff. Detailed examples are given, showing the development and progression of analysis. Chapter 5 presents the results from this work. Secondly, Chapter 6 explains what could be considered a more traditional qualitative study, nested within the broader action research process (Genat, 2009), used to gain a deeper understanding of visitors' experiences in the *Invisible Worlds* exhibition using photo-elicitation interviews. As in Chapter 4, detailed examples are given to show the process and development of analysis. Chapter 7 presents the findings of this visitor study.

Synthesising the two strands of work, Chapter 8 interprets and situates the results from both the organizational and visitor portions of the thesis within the wider literature. As is common in grounded theory research, some new concepts, such as institutional maintenance work and affordances, are introduced here to illuminate ideas developed during the analysis which were not apparent at the outset of the study. Finally, Chapter 9 concludes the thesis, summarizing the findings and discussing the limitations of the thesis.

2 Literature and conceptual review

This chapter reviews the science communication and museum literature relevant to the present study. First, it takes a close look at the origins and development of the deficit model, before outlining more recent approaches to science communication. It then looks at museum research, before detailing transformation as the central sensitizing concept of this thesis.

2.1 Pushing science communication beyond the deficit model

Starting a thesis about science communication without mentioning the much maligned 'deficit model' is practically unavoidable. The deficit model configures the problematic relationship science has with the public in terms of knowledge, who has it, and what it does. Ahteensuu's (2012) analysis of the deficit model identifies four axiomatic assumptions on which the model is based:

1. The public are ignorant.
2. The public has a negative attitude towards science.
3. Ignorance is the root of negative attitudes.
4. A knowledge deficit can be remedied by teaching facts.

In summary, science has True Knowledge, and the public do not. Public criticism of and negative attitudes towards science are the result of a lack of scientific knowledge. It follows that if the public had more scientific knowledge they would think more positively about and support science and its institutions (Ahteensuu, 2012; Millar and Wynne, 1988).

Since at least the 1990s, science communication scholarship has been dominated by discourse around the model, its demise, persistence, and occasional return. The deficit model nevertheless has arguably become a cliché in both science communication scholarship and practice, if not a 'straw man' (Sturgis and Allum, 2004, p.57). In this section, I go back to understand when and why the deficit model appeared in the science communication literature. Through a close reading of Brian

Wynne's work in proposing an alternative model of the public understanding of science (PUS) through the late 1980s and early 1990s, I show that the deficit's status as a model rests on shaky ground, with little theoretical or empirical basis and that it is a mistake to treat it as such. I propose reconstructing 'the deficit' as an ideological or rhetorical discourse, which urges recognition of a more reflexive relationship between science and society. By so doing, I show how attempts to move beyond 'deficit thinking' are stymied by resting on familiar naïve functionalist and essentialist theoretical assumptions that only result in its reproduction. I then outline recent alternative ways of thinking about science communication, which attempt to transcend deficit-dialogue discourses.

As a first step in breaking down the deficit model, it makes sense to trace it to its origins. However, one would be hard pressed to pinpoint exactly where and when it originated, and on what empirical basis. The earliest reference to what would become the deficit 'model' came from Robin Millar and Brian Wynne (1988), who outlined the supposed 'conventional' and 'dominant' approach to PUS at the time, that,

> *'If only the public was properly informed and 'understood' science better people would have a more positive view of what scientists say and do, and this would be reflected in wider popular support (and more generous public funding). Where specific technological applications of science are concerned there is a baseline of scientific knowledge, for example, of how a nuclear reactor works, or of the toxic risks of certain pesticides or food additives. The public have variable deficits of this technical knowledge and some deficits are pathologically large. The further implication of this dominant view is that if we could reduce these deficits of understanding, the public would react more 'maturely' to these things in everyday life, making government and industrial planning more stable and predictable' (Millar and Wynne, 1988, p.389)*

The authors used this description as a rhetorical tool to support the argument that PUS should consider the internal processes of science, rather than just its contents. While they provided little evidence for their interpretation, only briefly referring to the Bodmer report (Royal Society, 1985), published three years previously, and unspecified 'literature of risk perception' (Millar and Wynne, 1988, p.389), this lack of

evidence is not necessarily a problem in that the approach described is, at this point, not elevated to the status of an empirical or theoretical model.

Wynne did later develop this theoretical argument in the empirical context of the controversy over the impact and subsequent mishandling of Chernobyl fallout on Cumbrian sheep farmers (Wynne, 1992). He showed that while laypeople, in this case farmers, critically reflected on their knowledge and relationships with science, science as an institution was unreflexive to local and contextual expertise, which not only hampered its efforts but ironically damaged its credibility at the same time as it tried to bolster it. While not explicitly referring to a 'deficit model', Wynne offered a clear critique of deficit approaches, systematically showing how trust and credibility are rooted in material and social relations and interactions, rather than knowledge or understanding. Importantly for this thesis, Wynne identified social identity as the core unit of analysis in PUS, which he conceptualised as a position within plural and diverse networks of relations, open to continual negotiation and reconstruction.

It was not until 1993, when re-iterating his previous call for greater reflexivity that Wynne (1993) made the first explicit mention of the deficit 'model' as such, albeit only briefly described as:

> *'Laypeople are assumed to be essentially defensive, risk- and uncertainty-averse, and unreflexive. Science on the other hand is assumed to be the epitome of reflexive self-criticism.' (Wynne, 1993, p.321)*

Now, rather than being just about a knowledge deficit, the deficit model was, in line with Wynne's earlier work with Cumbrian sheep farmers, re-configured as a reflexive deficit. He conjectured that the proliferation of PUS was a result of increased focus on the public legitimation of science by what today we might call the neoliberalisation of research. Situated within the context of the 'crisis of late modernity' (Wynne, 1993), Wynne used the deficit model to draw out an argument about the legitimation strategies used by scientific institutions in response to their apparent diminished status in the public sphere, namely maintaining the modernist discourse linking objective scientific knowledge to rationality and social order (Wynne, 1995).

Key to note, however, is that the deficit model was always presented as 'more an ideological construct than a research model' (Wynne, 1993 p.322). Following through to the footnotes gives an indication of how the concept had been developed:

> *'The deficit model was a name given to the conventional approach by Wynne in a draft paper criticising it, for a workshop in Lancaster in May 1988 of the Economic and Social Research Council – Science Policy Support Group research groups under the phase I Public Understanding of Science Research Initiative. (Wynne, 1993 p.335)*

While its origins remain obscure, by the mid-1990s, the 'deficit model' represented an already conventional ideological critique of the prevailing approach to PUS, rather than a model upon which to base a research agenda in science communication. In its original conception, the deficit model, which remained un-elaborated, was only meaningful in comparison to the much broader theoretical argument Wynne was making at the time, which linked the PUS movement to late modernity and institutional legitimation, and offered reflexivity and a focus on social identity as remedies. In short, the deficit model is not and was never a model.

Regardless, it seems that after sustained critique of the PUS movement from sociologically inclined research (Miller, 2001), there was a growing desire for alternative approaches (Miller, 2001; Wynne, 1993), and the turn of the millennium provided new impetus. Declaring a 'new mood for dialogue' (House of Lords, 2000), the PUS movement seized this new 'model' of science communication, as well as the redemptive deficit to dialogue narrative which it supported, even if many such efforts did not actually lead to informing policy (Davies et al., 2009). Some early critics of the new dialogue approach presaged its problems. For example Miller (2001) warned of replacing the knowledge deficit with a 'consultancy deficit', while Irwin (2001) suggested the new 'mood' was more representative of an ongoing debate than a dramatic shift. He offered a robust critique of the new approach, arguing that the deficit approach whereby science is regarded as 'fact' and all else is mere opinion remained. As such, public engagement arguably acted more as an inconvenient permission-granting exercise for science, more akin to market research rather than what might be considered genuine dialogue (Irwin, 2001). Despite these warnings, in

the somewhat congratulatory narrative of a shift from deficit to dialogue, the argument about the importance of reflexivity and social identity was lost; the agenda became essentialised to deficit *versus* dialogue, one-way *versus* two-way communication.

Wynne's original argument outlined above stands in stark contrast to this theoretical work in the 2000's, which, while marking a significant development in the field, reductively identified direction of information flow as the primary matter of concern. This approach was typified by Rowe and Frewer's (2005) effort to typologise public engagement, criticising the unclear definition of terms in the field. To do this they drew on a model of communication, which focused on the directionality of information flow as its core variable of interest. This largely mechanistic view of science communication separated communicative events into three categories, communication, consultation, and participation. Their approach essentialised communication events as 'mechanisms' which have intrinsic properties that render them categorizable. The research agenda that this typology proposed was reduced to identifying new or alternative mechanisms, their properties, as well as research instruments for determining their 'effectiveness'. While the authors' definition of effectiveness remained unproblematised, the logical follow-on from these assumptions is that ineffective science communication is due to the incorrect selection or delivery of well-defined formats, rather than a fundamental problem with the underlying model of communication.

Similarly, Bucchi (2008) and Trench (2008) both created analogous typologies, which outlined deficit, dialogue and participation as categories. Bucchi, starting from a different point than Rowe and Frewer, critiqued the information transfer model, describing communication instead as a contingent, non-linear, active, and continuous process. It is surprising therefore that he arrived at the same conclusion. In this case, Bucchi's difference is perhaps emphatic rather than substantive, asking under which conditions different models might emerge, rather than which are most effective. Taking a third approach, Trench (2008) criticised the deficit to dialogue narrative, suggesting instead that the shift to two-way communication was more a partial, normative commitment than an actual change. As such, he asserted that creating a

strong binary between deficit and dialogue is neither accurate nor useful. Nevertheless, how the alternatively proposed trinary resolves this issue is left for the reader to speculate. In both cases, the authors suggested that multiple models of communication can co-exist within the same situation, which puts the analytical, explanatory, and practical usefulness of making the distinction between the three models into question.

In singling out these three attempts at topologising science communication, I am not aiming to unfairly criticise the important contributions they made to the field, but to highlight that a singular focus on direction of communication unnecessarily narrows the field of view of science communication scholarship. In general, as dialogue approaches matured, the literature gradually moved away from being congratulatory, to being more critical about the implementation of public engagement in practice (Smallman, 2016). There was growing concern that the change to public engagement may have been largely rhetorical after all, that difficulties in implementing dialogue might cause a regression in approach (Davies, 2009), or that the deficit model might persist 'in disguise' (Davies et al., 2009). Irwin (2006) was particularly strident in this regard, arguing that the modernist foundations of the PUS approach had not been rejected at all, but they were instead augmented by an approach to dialogue which highly valued consensus between science and society, regardless of whether it is desirable or possible in practice (Irwin and Michael, 2003).

There was disappointment within public engagement that the apparently dramatic shift towards dialogue was not quite as significant as hoped (Kurath and Gisler, 2009), with some suggesting that the deficit had simply been reinvented as a deficit in public trust (Irwin, 2006; Wynne, 2006). Public engagement approaches still created an artificial separation and boundary between science and the public (Kurath and Gisler, 2009), where the epistemic status of not-science, often branded as perception or misunderstanding, was yet to be determined (Irwin, 2006). Science still very much defined the pertinent issues at stake (Wynne, 2006). The status of the public in public engagement began to be questioned, as legitimate publics were constructed as static innocents or idiots, to be convinced or won over by engagement, while already engaged (and often critical) stakeholders or interest

groups were marginalised (Lezaun and Soneryd, 2007; Welsh and Wynne, 2013). Most importantly for science communication scholarship, asking questions about what was real or genuine in practice (genuine dialogue, real publics) began to be rejected, instead seeing these constructions as symptomatic of the science-society relationship itself (Irwin, 2006).

From these critiques came the idea that rather than entirely replacing the deficit model, the move towards public engagement represented a mixing of old and new approaches (Irwin, 2006). There was evidence that dialogue events, which did not inform policy, criticised for being deficit in disguise, were nevertheless valuable sites of mutual learning (Davies et al., 2009; Lehr et al., 2007). Even within the dialogue paradigm, difficulties were arising in taking a unified approach to evaluating public engagement, where different normative commitments around the science-society relationship produced very different ideas around what success should look like (Lehr et al., 2007). The theoretical work of Trench and Bucchi (Bucchi, 2008; Trench, 2008) in developing three co-existing models of science communication represented some of the most significant theoretical work in the field (Trench and Bucchi, 2010) and offered a slight vindication for the deficit model in that it became imaginable for deficit-based approaches to happily co-exist alongside dialogue. While Wynne never denied the existence of a knowledge deficit, only its explanatory usefulness (Wynne, 2006), arguments began appearing that information is after all a pre-requisite of democratic dialogue (Dickson, 2005). Such arguments suggested that the deficit persists because of its actual existence, which cannot be ignored (Cortassa, 2016), that most activities rely at least in part on the deficit model anyway (Metcalfe, 2019) and most recently, that the deficit model could be 'improved' by testing mediating factors (Abunyewah et al., 2020).

I argue that vindicating the deficit model in this way is a mistake. Wynne's original critique raised several useful sensitising concepts, such as social identity, late modernity, reflexivity, and institutional legitimation, which science communication scholarship in the main has left by the wayside. Over the last 20 years, the deficit model has been reduced to shorthand for simply providing information, or the assumed direction of communication. With its original context stripped away, the

reasons as to *why* the deficit approach was and remains dominant have seemingly been forgotten, with some notable exceptions. Some have considered the practical reasons for the persistence of the deficit model, such as lack of time, resources, support, or experience to do otherwise (Jensen and Holliman, 2016). The nature of scientific training and lack of suitable communication training may be to blame (Simis et al., 2016). Or perhaps scientists' negative attitudes towards the public (Marris, 2015; Simis et al., 2016) and engagement itself (Davies, 2008; Marris, 2015) are the issue. More convincingly, others have re-asserted the deficit model's power in granting science epistemic privilege over other ways of knowing (Suldovsky, 2016), which strengthens science's influence over policy and the public sphere more broadly (Simis et al., 2016), in some cases far beyond what might be considered its remit (Welsh and Wynne, 2013).

Superficially, re-invention or vindication of the deficit model resembles an appeal to common sense; a real knowledge deficit between science and the public exists (Cortassa, 2016) and providing information to the public is unquestionably better than leaving them in the dark. But as I have argued, the deficit model is about more than just direction of information flow. The deficit approach represents attempts at institutional legitimation in the face of strained public credulity, ultimately leaving many areas of contention closed off from public critique, even in two-way 'engagement' models (Bauer and Bogner, 2020; Marris, 2015). To vindicate the deficit model is thus to reproduce the power imbalance between science and society which Wynne identified in the late 1980s and early 1990s. In any case, the deficit model remains in crisis, as Schiele (2008) has argued, not just because it does not 'work', but because in an era of information abundance, social media, and increased public scrutiny, its ideological basis of pacifying a largely disinterested public faced with seeming inevitable scientific and technological progress no longer holds water.

Amongst this debate, new approaches have begun to emerge which attempt to transcend the deficit-dialogue divide. Earlier work showed that public engagement was uncertain and multiple in its norms and framings, shifting between 'genres' of communication (Davies, 2009), or characterised by 'conflict' whereby imposed power hierarchies were continuously re-negotiated (Davies, 2013). This reflects

Metcalfe's (2019) recent assessment of science communication activities in Australia, showing that no one format could be reduced to just a simple 'direction of information flow' model of communication. There is now an increased appreciation that science communication has a range of individual, educational and political motives, which are often contradictory, in conflict or competition with one-another (Davies, 2019b; Weingart and Joubert, 2019). Ultimately, this work builds a picture of engagement as an activity that is ill-described by deficit-dialogue, where practitioners and publics make complex, nuanced, and spontaneous negotiations of power dynamics within pragmatic constraints (Davies, 2011; Hetland, 2019). Rather than being fixed entities, science communication and the people involved in it are embodied, interwoven and hybrid (Michael, 2002). The relational and ecological view of science communication, which follows from these realisations, ultimately developed by Davies and Horst (2016), reflects wider meanings of science communication beyond information transfer, emphasising embodiment and materiality.

This new approach to thinking about science communication sees communication not as information transfer, but as meaning-making (Davies et al., 2019), a symbolic process which both produces and maintains a social reality (Blue, 2019). Echoing Wynne's earlier work, there is a renewed focus on the role of identity (Davies et al., 2019) in science communication, expanded to include all actors, not just publics. These actors are not seen as static entities, but as emergent, being produced by and themselves producing science communication as an 'event' (Horst and Michael, 2011). One focus of research is on how actors are constructed through processes of differentiation and identification (Michael, 2009), for example how public engagement distinguishes between and assigns variable value to stakeholders and the general public (Lezaun and Soneryd, 2007). Dawson (Dawson, 2018), extending this idea into the realm of social justice and social reproduction, has shown how narrow constructions of publics actively exclude participants and serve to reproduce structural inequalities.

The thrust of this work is that what we think of the public, scientists or communicators are not just perceptions, but that these figures are constructed and

maintained through action shaping what is possible or allowed (Horst and Michael, 2011). One theoretical concept, which arises from this idea is that of the idiot, derived from the ancient Greek to denote a person concerned only with their personal affairs, not taking any interest in public civic life. Introduced by Lezaun and Soneryd (2007), they showed through case studies of the UK debate on GM foods and Swedish dialogue around mobile phones that public engagement strongly values what they call mobility, in other words changing public opinion. This commitment excludes those with already formed opinions, leading to the only legitimate public being 'the person with no known opinions or unprompted interest in public matters' (Lezaun and Soneryd, 2007, p.294). Idiots are highly valued because of their apparent usefulness and representativeness of an imagined silent majority or general public, while those with prior interest or concern are relegated to the status of stakeholder – unrepresentative and potentially threatening. Horst and Michael (2011) have taken the idea of the idiot further, drawing on Stengers' (2005) conception of the idiot to challenge how our assumptions about science communication both enable and constrain identity and behaviour. While, for example, some public behaviour may, based on our prior assumptions, seem idiotic, Horst and Michael challenge us to pay attention to how science communication inevitably overspills the boxes we put it in (Horst and Michael, 2011; Michael, 2012), to ask, 'what are we busy doing?' (Michael, 2012). Ultimately, communicating scientific facts is rarely the be-all-and-end-all (Davies, 2019b) and a shift away from deficit-dialogue shows us that there is so much more happening than just transfer of information.

This realisation creates a fundamental challenge for science communication practice. If we were to move the focus away from information transfer, then what? Some recent studies exemplify emerging new approaches. For example, Seethaler and colleagues (2019) advocate for scholar-practitioner partnerships, outlining a competency based approach to science communication which encompasses values, decision-making, uncertainty and diversity as key themes. Stofer and colleagues (2019) placed scientists in unconventional and mundane settings, developing an approach to engagement, which allowed for personal interaction, relationship-building and mutual learning. Similarly, Nadkerani and colleagues (2019) encouraged

scientists to engage pre-existing groups in their own settings, developing relationships by integrating personal interests and experiences into their research communication. Taking a similar approach from a risk communication perspective, Cook and de Melo Zirita (2019) argue that even participation formats re-construct the deficit model by placing expert-imposed boundaries on participation. They strongly advocate for equitable relationship-building as an alternative to deficit approaches. This recent work points to a growing interest in identity, setting (and thus materiality), relationships and personal interaction as ways forward, as well as a focus on the importance of practice and process over knowledge outcomes (Cook and Melo Zurita, 2019).

2.2 The substantive context: Museums

Moving from the wider context of science communication, in this section I address the setting of informal science learning institutions. While there are many types of such institutions, including museums, science centers, botanic gardens, and zoos, here I refer to museums as a useful catch-all term (for information about the specific context of the Eden Project, please refer to Section 1.1). I start by outlining the state of play in UK museums at the start of the 21st century, following a move from the 1970s to a more learning- and visitor-focused so-called 'post-museum' (Watermeyer, 2012). I then outline several recent strands of museum research. Rather than trying to be comprehensive, I aim to highlight the key ideas that are most relevant to the substantive context of this thesis.

Since their foundation in enlightenment philosophy and 19th century commitment to education, and their evolution from cabinets of curiosities and world fairs, one of the main functions of museums has always been in public education (Gregory and Miller, 2000). However, it was not until the late 20th century that education took the central place in the work of museums and other similar institutions which it has today. Throughout the 20th century, the role of education in museums gradually increased (Hooper-Greenhill, 2007), reaching a critical mass by the mid- to late-1990s. At the same time, several influential reports, and new funds from the New Labour

government in 1997 saw a rapid change in UK museums' support for education and learning. As Hooper-Greenhill described,

> *'At the beginning of the twenty-first century, cultural organisations have to fight hard for survival in a political environment shaped by economic rationalism. An instrumental approach to culture demands evidence of value for public funds, sponsorship and the provision of resources.' (Hooper-Greenhill, 2007, p.8)*

These changes led to a renewed impetus to evidence learning and impact through research and evaluation. While early research in museums had taken a behaviourist approach to measuring learning (Falk, 2004; Falk and Dierking, 2013, 1995) under the assumption that more attractive exhibits with clear, explicit meaning would cause visitors to stay longer and therefore learn more (Falk, Koran and Dierking, 1986), there was growing frustration throughout the 1990s that there was still little empirical evidence of museum learning beyond anecdote (Ramey-Gassert, Walberg and Walberg, 1994). Behaviourism struggled to account for the complex types of learning which occur in museums (Dierking, 1996). Contemporary research indicated contextual and affective factors were at least as important as cognitive (Rennie and McClafferty, 1995). As a result, constructivist (Hein, 1999) and contextual (Falk and Dierking, 2000) approaches to learning became popular, with greater emphasis on individualised experience and qualitative sociological and ethnographic methods (Phipps, 2010). The language of education shifted from knowledge acquisition to learning and meaning making (Silverman, 1995). Rather than offering ready-made meanings, the role of the museum became to empower visitors' meanings through narrative and experience, emphasising multiple, personal interpretations (Grek, 2009). The obvious contemporaneous parallels to the deficit conversation in the PUS movement are unsurprising given museums' prominence in the arsenal for improving public understanding of science (Ucko, 2010; Ziman, 1991), and the prevailing political milieu during the period.

Ultimately, these intersecting political, theoretical, and practical changes led to the uptake of a 'new museology', founded on post-modern principles and with a theoretical focus on the purpose of museums, rather than the more practical arena of methods (Vergo, 1997). The hypothesised embodiment of this new way of doing

things was the 'post-museum', a reflexive re-imagining of the identity of the museum (Hooper-Greenhill, 2007) to suit a pluralistic and multicultural society (Ross, 2004). The post-museum incorporates increasingly playful and creative, personalised and individualised experiences, portraying partial narratives 'in the making' (Watermeyer, 2012, p.6) in which the audience are directly implicated (Smith, 2014). From an epistemological perspective, the function of the museum is changed to that of a knowledge broker (Watermeyer, 2012), where knowledge is constructed, multi-dimensional, and political (Smith, 2014). As such, nothing in or of the museum is rendered neutral. As Mancino highlighted (2015), funding, public programmes, and even the physical space of the museum take on rhetorical and political functions:

> *'The physical construct of the museum becomes rhetorical as it guides visitors through an embodied spatial experience... These experiences are rhetorical as they transport and personalize artifacts from the exhibit to one's embodied understanding...' (Mancino, 2015, p.266)*

In the context of science museums specifically, Watermeyer has asserted that,

> *'...the post-museum is the enactment or performance of scientific knowledge, made apparent and available through a process of creative and participatory visualization... The post-museum is a process of investing science with its social and cultural heritage and imagining its cultural legacy... It is a process of humanizing science or making science known through the project of being human.' (Watermeyer, 2012, p.3)*

While the uptake of the concept of the post-museum has resulted in increased audience awareness and reflexivity on the part of museums, as Ross (2004) has explicated, this change is marked by tension between pressures to increase accessibility and the threat of losing professional identity. Ultimately, Ross questioned to what extent the push towards the post-museum has been effective, showing that museums are resistant to such change, and that commercial pressures lead to visitors becoming consumers who leverage their cultural and economic capital to gain access, stymieing the democratising promise of the post-museum. Similarly, McCall and Gray (2014) question the new museology's achievements, showing that internal staff tensions and structural challenges limit its uptake. While they found that workers saw the old and new ways of doing things on a nuanced continuum of

practice, these tensions, pressures, and challenges forced workers to resolve the ambiguity by taking one side or another. Perhaps most damningly, Watermeyer (2012 : p.2) has characterised the visitor experience in the post-museum as,

> *'a fractured and inchoate repertoire of mini-epics and entertainment detours which enervate the capacity of the visitor to accrue deeper, more nuanced and complete observations and associations. The museum narrative is in this context obscured and atomized. Far from a lucid and intelligible interface with new knowledge the museum visit is confounded by a tendency to induce a disparate jumble of impulsive behaviours... which cause the homogenization and stasis of its public experience and inefficacy as a catalyst inspiring knowledge and learning.'*

Dudzinska-Przesmitzki and Grenier (2008) argued that the resultant lack of theoretical clarity has led to research being dictated by funding or political motives to prove museum programmes work, rather than generating new insights. While Grek (2009), reaching the same conclusions, claims that an emphasis on constructivist learning theory means research fails to challenge the 'truth' communicated by museums, instead subscribing to a managerialist culture of measuring and reporting. The 'new clothes' of an empowered and self-directed visitor cover up the lack of attention to who decides what visitors learn and why (Grek, 2009). MacDonald (1998) is particularly scathing in this regard, seeing this new way of creating exhibitions as offering visitors false choice, and characterising visitors as easily bored, inattentive and lacking cognitive ability. Choice, consumption, and fun are seen as democratisation of the museum, offering agency and empowerment, whilst the implication from MacDonald (1998) is that constructivist approaches simply offer a commodification of museums as part of an 'experience economy' (Pine and Gilmore, 1999).

In that vein, much of the museum literature is occupied with tracking visitors in increasingly technologically sophisticated ways (Moussouri and Roussos, 2013; Mygind and Bentsen, 2017; Schautz, Dijk and Meisert, 2016; Yalowitz and Bronnenkant, 2009), optimising design elements of exhibitions (Chen and Tsai, 2015; Gutwill and Dancstep, 2017; Jeanneret et al., 2010; Phipps, Rowe and Cone, 2008), or measuring and segmenting visitor identities (Falk, 2016, 2011; Falk, Heimlich and

Bronnenkant, 2008; Rowe and Nickels, 2011). These trends can be seen as a wider move to marketise museums in response to stagnant visitor attendance and increased reliance on visitor income streams (Message, 2006). Rhetoric around accessibility is compromised by emphasis on being appealing, relevant and interactive (Message, 2006), meaning that inclusivity is interpreted as a marketing exercise to increase attendance (e.g. Lawton and Daniels, 2009), rather than an opportunity to reconsider museum work through the lens of social justice (Kinsley, 2016). For example, Booth (2014) has argued that the trend in measurement of numbers and types of visitors undermines the other forms of value which museums can provide, and neglects to appreciate that museums do not exist within a cultural vacuum (Booth et al., 2017), but amongst existing social structures and dynamics.

Despite the relative disillusionment of the post-museum concept (which can be seen in parallel to the relative disillusionment with public engagement and dialogue in science communication), the move, albeit arguably partial and often limited in practice, has seen a rich range of theoretical perspectives brought to bear on museums, some of which are discussed in the following section.

2.2.1 More than learning outcomes: Identity, emotion, narrative

The first significant strand of theoretical work addressing the post-museum was spearheaded by Eilean Hooper-Greenhill (2007), who developed Generic Learning Outcomes (GLOs) designed to be easily used by practitioners, whilst being open-ended to neatly avoid the trap of falling into old behaviourist ways. The GLOs divide learning in museums into five dimensions (Hooper-Greenhill, 2007):

- Knowledge and Understanding – Learning facts or information, gaining deeper understanding, grasping meaning.
- Skills – Knowing how to do something. Skills can be cognitive, intellectual, social, emotional or physical.
- Attitudes and Values – Result from the absorption of new information and inform decisions people make about how to live their lives.

- Enjoyment, Inspiration, Creativity – The development of positive learning identities and the desire to repeat an experience.
- Activity, Behaviour and Progression – Actions, either observed, intended or remembered.

The GLOs were rapidly and widely taken up in museum practice, used to provide evidence of museum learning, and providing a shared vocabulary for the field. However, perhaps due to their rather definitive nature, the GLOs have found much more use in practice than in research. Brown (2007) has critiqued the GLOs, stating that they are subjective, post-hoc measures, only indirectly related to learning. These problems mean that the GLOs are limited in usefulness to summative, rather than formative approaches. To resolve some of these issues, Brown (2007) , influenced by Laurillard (2002), proposed an experiential approach to learning in museums, focusing on opportunities for visitors to engage with the following learning processes:

- Attending or apprehending
- Investigating or exploring
- Discussing and debating
- Experimenting and practicing
- Articulating and expressing

Brown's critique seems not to have been widely taken up in the literature, although a refocusing on process over outcomes does reflect a similar trend in science communication, described above. In addition to Brown's critique, while the GLOs' comprehensive scope marked a helpful development of the field which reinforced the growing consensus that knowledge and understanding were only a small part of museum learning, their comprehensiveness is also their major weakness. By attempting to uncontroversially encapsulate all possible learning outcomes in all contexts, the GLOs say little about the substantive peculiarities of learning in museums. This flaw is perhaps due to the context of instrumentalism and evaluation within which the GLOs were developed (Hooper-Greenhill, 2007).

By defining learning in such a broad and open-ended way, it makes it easy for museums to evidence visitor learning to funders, and at the same time almost impossible to claim that learning is not happening in museums. As such, the GLOs function as a powerful political tool for the museum sector which can be leveraged to gain funding and resources. Indeed, such open-endedness is not unwarranted; contemporary theories of learning see learning as a continuous process of being and becoming (Jarvis, 2009). But while the GLOs apprehended the *what* of museum learning, they left open the questions of *how* and *why*.

Taking up these questions, John Falk and Lynne Dierking's work on the museum visitor experience provided a conceptual framework to open up the black box of museum visiting somewhat (Falk and Dierking, 2000, 2013). Drawing on extensive research in the informal science learning sector, mostly in an American context, they developed a contextual model of learning which identified the following pertinent mediating factors:

- The Personal Context – Experience, interests, attitudes, motivations etc.
- The Sociocultural Context – Culture, customs, language, ethnicity, social class etc.
- The Physical Context – Museum architecture, arrangement of objects and artefacts, physical accessibility etc.
- Time – The continuous construction of and interaction between contexts.

Within the Personal Context of the model, the authors also introduced identity-related motivations, upon which Falk has since expanded (Falk, 2009). The motivations, listed below, represent a well-formed, pre-existing expectation or agenda for a museum visit based largely on prior interest and knowledge (Bond and Falk, 2013; Falk, 2009):

- Explorer – Satisfying curiosity and interest.
- Facilitator – Engaging in a meaningful social experience with someone you care about.

- Experience-seeker – Being exposed to exemplary culture.
- Professional/Hobbyist – Furthering specific intellectual needs.
- Recharger – Physically, emotionally and intellectually refreshing oneself.
- Respectful Pilgrim – Fulfilling a duty or obligation to honour those represented.
- Affinity-seeker – Engaging in a sense of heritage or personhood.

Falk and Dierking's perspective represented a shift in thinking about museum visiting beyond exhibition content or simple measures such as visitor demographics. The contextual model of learning, alongside the identity-related motivations, provided an explanatory framework for visitors' seemingly idiosyncratic behaviour as well as resolving previous problems of explaining visitor learning. Learning in the contextual model, similarly to the GLOs, is about reinforcement, social learning, identity and self-awareness, confidence and aesthetics, rather than just facts. Furthermore, shining a light on the sociocultural context of museums provided support for renewed emphasis on community engagement and relationship-building (Falk, 2009).

Dawson and Jensen (2011), however, have extensively critiqued the contextual and identity-motivation approach to visitor research, arguing that reductive audience segmentation problematically essentialises identity and erases complexity, multiplicity, and change. Instead, they advocate for a more contextually sensitive approach to visitor research, which treats individual life circumstances and trajectories holistically. The practical consequence of Falk's approach, they claim, is exclusion through the construction of well-defined demarcations around categories of possible visitors. They reject the claim that the approach is predictive, and perhaps unjustly and pejoratively characterise it as behaviourist.

While Falk and Dierking's approach does emphasise prediction, behaviour, and cognition, the focus on visitors' imagined or perceived sense of museums (Falk and Dierking, 2013b) suggest vestiges of a critical realist epistemological grounding, while also in some places implying loosely constructivist influences, at least as far as identity and learning is concerned (Falk, 2009; Falk and Dierking, 2013). This

epistemological confusion perhaps indicates more underlying problems. The model is emphatically broadly a-theoretical, eschewing 'esoteric philosophical analysis' (Falk, 2009, p.37), in favour of a 'pragmatic' approach. Indeed, Falk's (2011) response to Dawson and Jensen's (2011) critique draws strongly on American pragmatism to bolster its claim to methodological validity, citing classical influences from the likes of Pierce, James and Dewey (e.g. Dewey 2007 [1938], James 1907, Pierce 1905). However, pragmatism in the contextual model is perhaps unconventionally interpreted as an anti-theoretical, 'anything goes' approach to research which sidesteps theoretical discourse (Falk, 2011), rather than engaging in a more conventional focus on action, experience, and usefulness. The consequence of this interpretation is a logically inchoate model of museum visiting which places reductive emphasis on cognitivism and determinism, leaving blind spots where visitors might express their agency for spontaneity, improvisation, unexpectedness, speculation, or imagination. While an active view of the visitor (Falk and Dierking, 2013) is welcome, the contextual approach implies a model of action based on conscious, pre-determined and discrete motivations, as well as instant and direct recall of relevant and prescient knowledge and experience to contextualise the visit. Well-defined, *a priori* leisure needs are taken at face value, rather than critically examined as constructed through marketing and consumer culture. Emotion and affect, while mentioned as important (Falk, 2009), and developed further by Falk and Gillespie (2009), are treated as mediators of an underlying cognitive process, rather than as part of experience as *Gestalt*. As a result, the contextual and identity-motivation models say much more about mediating factors of a museum visit, rather than the museum experience as experienced.

The contextual and the identity-related motivation models have done much to conceptualise an active visitor, highlighting that the determining factors of the museum experience are rarely defined by the museum itself, but from visitors' own agendas (Falk, 2011). Alongside the introduction of the models, there has been a growth of research interest in *experience* in museums, especially within visitor and tourism research. This research can broadly be summarised under three emerging schools of thought on experience. Firstly, the work of Falk and Dierking outlined

above can be seen to focus on identity, albeit with some theoretical challenges. This area of research, taking a largely psychological perspective, suggests the primacy of identity in motivating all experience, and that museum visiting establishes, maintains, and re-creates identity (Bond and Falk, 2013).

Bastiaansen and colleagues (2019), in contrast, identify emotion as the core element of experience. Drawing on research using biometric and neuroscientific methods, they contend that the memorability of an experience is determined by the flow of positive and negative emotions. While this physical model of emotion has some serious limitations in being able to measure biological responses which may have variable individual and cultural significance (see e.g. Shott, 1979), this represents a fundamentally different approach to Falk and Dierking, in that rather than being a mediating factor of an identity-related cognitive process, they see emotion as definitive in itself.

Finally, Packer and Ballantyne (2016), take a different approach entirely, singling out narrative as the main factor of the visitor experience. Attempting to synthesise conceptualisations of experience from anthropology, psychology and tourism research, they draw on a pragmatic definition of experience (after Dewey, 2007 [1938]) as an interplay between internal and external resources to create a comprehensive definition of experience. Here they define experience as, ‘an individual's immediate or ongoing, subjective and personal response to an activity, setting or event outside of their usual environment’ (Packer and Ballantyne, 2016, p.133), with the corollaries that experience is personal and subjective, responsive to the affordances of external settings, bounded in time and space, and significant to the visitor. Ultimately, they conclude, in direct disagreement with Falk and Gillespie (2009), that emotional intensity is not a precondition of memorability, but that instead it is visitors’ ability to create their own narratives, which defines an experience as extraordinary or remarkable.

Ultimately, whichever facet of visitor experience is most important is likely a matter of research perspective, and each approach can provide valuable insights. What is

important to note for this thesis is that current research suggests identity, emotion and narrative as key sensitising concepts around visitor experience.

2.3 Transformation as a sensitising concept

This review has thus far outlined several emerging areas in science communication and museum research that point to compelling sensitising concepts around which to ground the work of this thesis such as identity, materiality, relationships, social interaction, practice, process, emotion, narrative. Each of these concepts points to *change* as an underlying theme, be that change in public opinion as a result of relationship-building between scientists and the public, change in visitors as a result of a moving museum experience, or change in practice between deficit and dialogue, old and new museology. It is arguably no longer sufficient to inform or entertain; both science communication more broadly, and museums engaged in science communication more specifically are expected to evidence profound change in both publics and practice. Museums and cultural forms of science communication thus form part of an emerging 'transformation economy' (Mermiri, 2009); museums become reflexive institutions, while visitors and the general public become 'aspirants seeking…change' (Mermiri, 2009, p.75). Rather than falling into the trap of dwelling on whether this emerging language of transformation is simply hyperbolic rhetoric or actually borne out in practice, it is interpreted as symptomatic of the ecology of science communication in culture. This common narrative of transformation reflects, as part of an ecology of practice, increasingly fierce competition for public and charitable funding, public attention, and epistemic authority within a managerialist culture of evidence and reporting. Alternatively, it shows the potential and willingness of institutions to navigate the complex tensions which arise from this competitive ecology between power and change, neutrality and challenge, entertainment and enrichment (Clover, 2018) for public benefit.

While exhibitions often claim to be transformative, in general little research has been done with respect to transformation in museums (Soren, 2009), and its meaning remains unclear (Hoggan, 2016; Soren, 2009). Soren (2009) has suggested potential triggers of transformation lie within the affective domain, and argued that changes in

attitude, values, and motivation identify and predict transformation. Smith (2016) took this idea further, asserting that profound emotional engagement it is not sufficient alone. She used interview data to show emotional intelligence is also needed to link the emotional response to imagination, to critically reflect and imagine a new way of being. The weakness in both Smith and Soren's approach is that both rely heavily on in-visit data, not following up visitors to see whether the 'destabilising moments' (Smith, 2016) observed result in longer-term change. As such, much of the theoretical underpinning is incomplete without a longitudinal research design, and remains speculative. Garner, Kaplan and Pugh (2016) put forward design principles for 'developmental engagement', based on Pugh's work on transformational experiences in the classroom (Pugh, 2011), which aim to transform visitors through identity exploration. They argued for a reversal of the typical design approach, which leverages self-interest to develop interest in museum artefacts, instead leveraging artefacts to develop self-exploration.

Taking work to date on transformation in a museum context, the foundational concepts of emotion, emotional intelligence and identity, lay clear pathways to where research may progress in the future, situating it broadly in line with research on the museum experience outlined above. However, the research on transformation in an exhibitions context remains sparse. Heeding the warning that a lack of theoretical grounding leads to work motivated by politics and funding (Dudzinska-Przesmitzki and Grenier, 2008), the remainder of this section attempts to gain a fuller appreciation of transformation by drawing on theories of transformative learning from adult education.

The concept of transformative learning is useful for three reasons. Firstly, transformative learning offers the potential to transcend the previously outlined classical deficit-dialogue issues in science communication by being a form of change, which is non-normative and explicitly does not require knowledge acquisition. Secondly, the theory focuses on the process of change, filling in a significant blind spot from the visitor experience research outlined above which tends to focus on mediating factors while offering no mechanism for change. Thirdly, drawing on adult education theory ameliorates critiques that museum research

mistakenly assumes that theory suitable for children is applicable to adults (Dudzinska-Przesmitzki and Grenier, 2008) as well the lack of research on adult learning in museums in general (Banz, 2008; Grenier, 2010).

It is interesting to note at this point that museums may have been excluded from adult education research because they are seen as elitist, colonialist and exclusionary (Clover, 2015). The adult education literature often takes an explicitly critical stance towards museums, drawing, for example, on critical pedagogy (Borg and Mayo, 2010; Sandlin, Wright and Clark, 2013; Zorrilla and Tisdell, 2016) and feminist (Clover, 2010; Spring, Smith and DaSilva, 2018) critiques. Illeris (2006) has critiqued neo-liberal discourses around individualised learning by de-constructing museums' conceptions of audiences, arguing that empowerment is not just being learner-centered, but considering learning for the benefit of society. Echoing Dawson's (2014) work in science communication, Christensen-Scheel (2018) questions whether museums as 'products' can justify their existence without a commercialised audience, suggesting that targeting audiences may serve to replicate discriminatory practice. Likewise, Bell and Clover (2017) warn against the commodification of culture and the tensions it brings to museum practice, such as between community ownership, participation, quality, and criticality (Christensen-Scheel, 2018). But whilst museums are still seen to propagate the narratives of dominant power structures (Voelkel and Henehan, 2018), they are paradoxically seen to have the potential to expose, challenge, and renegotiate them (Bell and Clover, 2017; Borg and Mayo, 2010; Clover, 2018). Optimistically, Johnson (2016) has stated that museums' history of colonialization is in transition – museums are re-framed 'provocateurs of critical thinking' (Clover, 2018, p.100).

From this background of critique there is growing recognition of the potential for museums to facilitate consciousness change (Clover, 2018). Such change, conceptualised by Jack Mezirow, posits that transformation as not a change in *what* (or how much) we know but *how* we know (Kegan, 2009; Mezirow, 2009). This is an essentially epistemological change or new 'frame of reference' (Kegan, 2009; Mezirow, 2009) shaped by and shaping identity (Demerath, 2006; Illeris, 2014b, 2014a). Strongly influenced by the works of Kuhn, Habermas and Friere (Calleja,

2014), since its inception, research in transformative learning has developed to see transformation as a complex, non-linear process (Taylor, 2000), consisting of four major components (Taylor, 2007):

- Disorienting dilemma – An occurrence which challenges existing ways of seeing the world.
- Critical reflection
- Relationships – Developing trusting relationships with others.
- Identity

While the emphasis of Mezirow's approach to critical reflection has been criticised as being overly cognitive (Dirkx, 2008), the concept has been expanded to incorporate aspects of imagination (Dirkx, 2001) and the discovery of the self through emotional exploration (Dirkx and Espinoza, 2017). Similarly, Illeris (2014a), building on Mezirow's work, has proposed a re-definition of transformative learning as development or change in aspects of identity in (and in response to) post-modernity.

Within this framework, museums are re-framed as 'sites of transformation' (Marsden, 2018, p.141), which use social inclusion to facilitate individual and social change (Booth, 2014). Herbers (1998 quoted in Taylor, 2010) recognised museums as sites, which could provoke a disorienting dilemma. Grenier and Hafsteinsson (2016), for example, more recently identified the drastic events in Iceland following the global financial crisis as an external disorienting dilemma, which a local museum used to shift the role of its audience from distraction-seekers to that of adult learners. They argue that re-considering visitors allows opportunity for reflection and the disruption of worldviews, but urge caution in striking the balance of unsettling visitors (Johnson, 2016) with a sense of safety and familiarity.

The present study, building on this work, attempts to explore transformation in a museum context, to ensure that rather than '…leaving [museums] to laissez-faire learning outcomes such as 'that was interesting', [museums] are working to operationalize their full, transformative potential' (Clover, 2015, p.310).

2.4 Chapter summary, research questions, aims and objectives

This chapter has outlined the most important concepts for the present research and their relationship to the substantive literature. Through a close examination of the deficit model, I have argued that rather than being a research model based in an empirical reality, it is an ideological critique centering around ideas of epistemic authority and institutional legitimation. Drawing on museum learning research, I have shown how both science communication and museum learning are occupied with understanding and enacting change. I conceptualise this change as transformation – a concept which evokes an impression of profound, personally meaningful change, but which is still an emerging concept within a science museum context. Transformative learning theory, as one way in which such change has been theorised, offers an interesting perspective, which, as a form of learning that is not based on knowledge acquisition, may be productive in seeking new ways of thinking about science communication beyond direction of information transfer as the prime variable of interest. In summary, the review has generated a range of sensitising concepts, which lay down a conceptual starting point for the present research: Transformation, identity, materiality, relationships, social interaction, practice, process, emotion, narrative.

Following on from this discussion, this thesis aims to re-conceptualise transformation in a science communication context, through the creation of generative theory and the facilitation of reflection-in-action with the Eden Project exhibition team. This aim is broken down into the following research questions which act as sensitising prompts in the subsequent analysis:

1. How can we better conceptualise transformation in an exhibition context?
    a. How do the *Invisible Worlds* team construct *Invisible Worlds*?
        i. How does this construction influence the exhibition itself?

And, developed in collaboration with the Eden project team (see Chapter 4):

    b. What aspects of the *Invisible Worlds* exhibition design create transformation?

i. How could transformation be promoted or increased?

To meet the above aim, and respond to the research questions, the thesis addresses the following objectives:

- Combine action research and grounded theory methodologies to create an understanding of transformation which both contributes to science communication theory and is useful for practice.
- Initially, conduct a modified Delphi process to, in collaboration with the Eden Project team, identify potential research questions and a working understanding of transformation from which to start the research.
- Following on from the Delphi process, conduct a photo-elicitation study with visitors to *Invisible Worlds*, to understand their process of transformation, or otherwise.
- Through a variety of methods, trace the construction of *Invisible Worlds* through the exhibition development process, as a transformative experience.
- Synthesise the visitor and organisational aspects of the research to deepen our understanding about how we might understand transformation for science communication, and how practice might incorporate this understanding.

Having detailed the research questions, aims and objectives, the thesis now moves on to the methodological discussion which underpins the research.

3 Methodology

This chapter outlines the methodological basis of the thesis, which combines constructivist grounded theory and action research approaches. By methodology, I mean the argument which defines and legitimates research objectives and how they are to be reached (Knoblauch, 2019). I start by discussing the theoretical foundations that motivate the research approach, which, building on Illeris' theorisation of transformative learning introduced in the previous chapter, is influenced by Bauman's concept of liquid modernity (Bauman, 2000). This approach emphasizes the emergent character of science communication, seeing it as more akin to improvised theatre than well-rehearsed dramaturgy (Clegg and Baumeler, 2010). I outline grounded theory, action research, and my perspective on their combination. The chapter ends by detailing the quality criteria of the research approach, as well as pertinent ethical considerations.

While this chapter presents a linear and unproblematic account of combining action research and grounded theory, this combination did not appear pre-formed at the outset of the project. Throughout the PhD process, my methodological sensitivity has developed (Bryant, 2017), and the methodological approach has developed alongside. Notwithstanding the inevitable messiness of the field, it was necessary to make research decisions spontaneously, based on partial information and within practical limitations. The account below represents the final result of this process. It represents the major influences in my methodological thinking, as well as some of the key ideas, which have guided me through the methodological messiness. The subsequent data generation and analysis chapters further elaborate the specific course of analysis.

3.1 Foundations

In the previous chapter I identified *change* as a theme cutting across the literatures in science communication, museum experience, and transformative learning. Now I briefly draw out another current, which underlies this theme of change, that of the status of modernity, and its relation to the methodological grounding of this present

study. While a comprehensive discussion and comparison of various theorisations of late modernity is beyond the scope of this chapter, it is nevertheless important to bring up briefly at this point because it is shared across most of the literatures identified in the previous chapter. What they have to say about modernity is sometimes contradictory, but always has important consequences for the assumptions we make about what science communication *is*, and how and what we can *know* about it.

A superficial summary of how the various literatures outlined in the previous chapter have approached modernity reveals a great variety in perspectives. Firstly, critical science communication as conceptualised by Wynne in the 1990s (Wynne, 1993) emerged alongside Beck's analysis of late modernity, the development of risk society, what later became known as reflexive modernity, and the idea that the modern project had failed and was in crisis (Beck, Giddens and Lash, 1994). Without rejecting its foundations, Beck offered a resolution through reflection and deliberation. This thinking is reflected in Wynne's concern with risk perception and reflexivity, and motivated the turn to dialogue and democratic deliberation as a way out of the scientific controversies of the 1990s. Secondly, the more recent ecological approach to science communication, while also at least in part drawing on ideas of risk society (Felt and Davies, 2020), collapses the modern natural/social distinction, drawing on ideas from science and technology studies which advocate for a symmetric materialism, following Latour's declaration that 'we have never been modern' (Latour, 2012). Third, museum learning research, through ideas of the post-museum (Watermeyer, 2012), embraces constructivist tenets of post-modernity, relativism and the resultant plurality of perspectives. Finally, Mezirow's (Kegan, 2009; Mezirow, 2009) conception of transformative learning, resonating with the context of Beck's ideas of reflexive modernity, bridges the modern and post-modern (Mezirow, 1999) with its emphasis on critical reflection as the source of individual and societal flourishing. Illeris (2014a) has more recently extended Mezirow's work by drawing on Bauman's (2000) concept of liquid modernity, seeing transformation as a necessary process of identity change in response to a rapidly changing world.

The compatibility of different conceptions of modernity is moot (Lee, 2006) and as such, I make no claims to resolve the distinctions between these different theorisations. Instead, I take the view that multiple contradicting theorisations may be true at the same time, forming a critical dialectic with one another (Mezirow, 1999). Each conception of modernity provides a backdrop of potentially useful concepts. which provide understanding of and help to explain the wider contemporary social milieu. Nevertheless, echoing the most recent developments in transformative learning theory, comparing reflexive and liquid modernity highlights one distinction that is important for this thesis. While reflexive modernity relies on the individual capacity to make rational decisions based on critical self-reflection and experience, in liquid modernity, because of the ephemerality of society, conscious, rational awareness is replaced with sensual awareness; reflexivity is rendered irrelevant (Lee, 2006). It follows that new experiences are sought for the sake of being experiences in themselves without the need for understanding or rationalisation. The consequence for science communication scholarship and practice is to let go of the idea of well-defined, rational actors operating within static contexts. Critical reflection need not be a pre-condition of action. The concept of liquid modernity acts as a provocation to consider more or less fluid actors (communicators, publics, and others), drawing our attention to the non-rational and non-discursive (as also suggested by Davies and Horst, 2016).

Liquid modernity, therefore, has wide-ranging implications for our understanding of science communication. Bauman (2000) framed the contemporary world as existing in a state of competitive ontological pluralism and instability, where those who get to define the world are those who are most mobile and flexible. In liquid modernity, everything exists in a state of continual change. This change creates a kind of irony, in that it is ‘for the sake of a greater capacity for doing more of the same in future’ (Bauman, 2000, p.28). Arguably we see this in the continual reinvention of science communication practice, only to find that apparently new approaches reproduce the epistemic and institutional authority of science and undermine public empowerment. There is a tension between change and stability; the more things change, the more they stay the same (Alphonse Karr, 1862).

In this hyper-competitive, ever-changing world, freedom is not the capacity to make fully informed, rational decisions (as, for example, in reflexive modernity), but the ability to make decisions without consequence (Bauman, 2000). From this precept, Bauman presented two challenges – transforming the ability to choose to the ability to set the agenda of choice-making, and the tension between taking responsibility and being insulated from it. To continue the example of science communication, this means that empowering publics does not mean making sure they are well-informed and able to make rational decisions, or even making sure that publics are able to choose desirable outcomes. Instead, it means considering who is able to set the agenda for science communication, and who is able to make decisions about science without consequence. By setting these challenges, Bauman prioritised axiology over ontology, that is consideration of what is of value (as in ethics or aesthetics) over consideration of what is real (Doyle and Conboy, 2020).

This perspective is inherently challenging for traditional modes of science communication and public understanding of science. Researching how well-defined scientific knowledge is transmitted becomes meaningless when concerns over reality are de-prioritised, truth is problematic, and knowledge is essentially disposable. While Bauman (Bauman, 2000) painted an arguably pessimistic and extreme picture of contemporary society, it is not necessary to fully commit to a theoretical framework of liquid modernity to take its implications seriously. Instead, it is useful to make an abductive leap to imagine how Bauman's ontology of fluidity *might* be useful for understanding contemporary science communication. For example, Cameron (2015) has theorised that as future-predicting technology improves, in the liquid museum, the temporal focus shifts from the past to the future and the role of imagination becomes vitally important. In this 'future-present', time becomes an arbitrary sequence of idealised and future-oriented present moments (Clegg and Baumeler, 2010). Durability and duration become worthless, or even a liability (Bauman, 2000). Certainty in facts and knowledge breaks down, replaced by complex, non-linear processes (Cameron, 2015). As an institution, the liquid museum exists as a processual and emergent web of relations, 'a fluid entity in collectives actively making connections between things, and as a subject of unintended

consequences' (Cameron, 2015, p.353). The liquid museum can no longer rely on its status as an authority, instead it builds soft power through relational complexity and porosity, working to establish external relations and align with external interests. Clegg and Baumeler (2010) have further theorised that work in liquid organisations is flexible, temporary, insecure, with high levels of self-responsibility and unclear boundaries. Workers must be able to strongly identify with projects, making emotional investments to overcome risk and uncertainty whilst opportunistically making and abandoning commitments and loyalties without looking back (Clegg and Baumeler, 2010).

Considering these implications in the present study means starting from a multiple and relational ontology which sees reality as processual and constructed (Charmaz, 2014), and takes change as a given. Science and society are not *a priori* separable, cohesive or coherent entities. Instead science-society is emergent, constructed *ad hoc* (Irwin and Michael, 2003). This is a materialist and communicative constructivist position, which takes interest in how subjective meanings become facts, a taken for granted part of reality, and are maintained in the face of change (Berger and Luckmann, 1991). Firstly, it is *materialist* in acknowledging that we live in, act through and give meaning to the physical, embodied world (Clarke, Friese and Washburn, 2017). This approach centres the embodied action of communication as the key process in constructing social reality which itself limits and enables action (Knoblauch, 2019). Communication is not just about the appropriate selection of symbols and meaning, but a product of material and embodied action (Knoblauch, Forthcoming). The approach is therefore *communicative*, in assuming that 'everything which is of social relevance must be communicated' (Knoblauch, Forthcoming). Taking a communicative constructivist approach, compared to a conventional social constructivist approach, provides an explicit methodological motivation for studying *communication* as a significant form of action constructing the relationship between science and society.

The present research draws on Law's thinking that methods do not just create representations of reality, but produce realities themselves (Law, 2004). In that sense, methods are generative (Gergen, 1978); academic analysis takes part in the

production of science-society (Irwin and Michael, 2003) and motivates understanding not just of what it *is* but what it *could be* (Law, 2004). Being careful to avoid falling into the problems of extreme relativism and subjectivism, and acknowledging that construction happens within an already constructed world (Knoblauch, 2019), the idea of *multiplicity* (rather than pluralism) suggests that multiple social realities do not exist in isolation, but overlap and interfere: 'It is possible to observe, in one way very matter-of-factly, that the world, its knowledges, and the various senses of what is right and just, overlap and shade off into one another. That our arguments work, but only partially.' (Law, 2004, p.63). As such, while our understanding can only ever be contingent, provisional and partial, it can still have the power to travel through and affect interacting social worlds. The question becomes not what is real, but which realities, flexible, partial and contradictory as they may be, emerge in which contexts (Irwin and Wynne, 2003), which we can and should form through research, and how they interact in social worlds. These emergent and fluid social worlds consist of groups of actors who generate a life of their own, constantly changing in response to emergent conditions and interaction (Clarke, Friese and Washburn, 2017). This motivates an overriding methodological interest in *process* (Clarke, Friese and Washburn, 2017; Strauss, 1978), 'unfolding temporal sequences that may have identifiable markers with clear beginnings and endings and benchmarks in between' (Charmaz, 2014, p.17). Action is foregrounded, with individuals only coming to the fore when analytically useful (Clarke, Friese and Washburn, 2017).

The above discussion creates an uncertain foundation from which to proceed with research. Even careful consideration of multiple competing values and norms cannot guarantee being right in any objective sense (Bauman, 2000). Instead, conscious choices must be made between competing desirable realities (Law, 2004). The spotlight is moved from ontology and epistemology to the axiology of research, that is research value. We have to consider what *matters* to untangle how to create plausible and convincing, but necessarily partial and selective accounts. Law (2004) introduced two research 'goods' which might guide choice-making in this regard. Firstly, *truth* is the value placed in our work finding resonance in and through social worlds. As will be elaborated later in this chapter, this concept aligns with grounded

theory criteria of *fit* and *relevance* (Glaser and Strauss, 2009 [1967]), that is coherence to empirical data and focus on an important emergent substantive problem or process. Truth also corresponds to the concept of *resonance* in constructivist grounded theory, that theory should portray the fullness of experience, drawing links between individuals and larger institutions, and giving deeper insights about participants' worlds (Charmaz, 2014).

The second of Law's research 'goods' is *politics*, that is doing research to make certain realities more real, whilst diminishing others, thus rendering them less real (Law, 2004). Such a specious research good offers the prospect of doing research for the purpose of positive change, without offering an answer to the question of what or how to choose. Recalling Bauman's challenges of liquid modernity (Bauman, 2000), this prospect is highly problematic in that choice is associated with power. As a researcher in a position of power over participants, it is possible to frame the choice-making agenda whilst being insulated from responsibility, while those who may be disenfranchised (i.e. participants) bear the consequences of making the wrong choice (Bauman, 2000). How, then, can we make choices in research which empower participants whilst presenting truthful realities?

To answer this question, I suggest a research approach based in pragmatism, especially that influenced by Dewey (Dewey, 2016, 1930), as a form of inquiry by which actors can define and pursue problems which matter to them in ways which are meaningful to them (Dewey, 2016). Pragmatism is a philosophy of research which takes action and problem-solving as its central concepts of interest (Charmaz, 2014; Corbin and Strauss, 2015; Pansiri, 2005) and focuses on truth claims based on the consequences of human belief and action (Kaushik and Walsh, 2019). Pragmatic truth is always provisional (Charmaz, 2014), not a statement of what is, but rather 'acts to be performed' (Dewey, 1930, p.133). Truth is therefore found by and through action; what is true is what works (Kaushik and Walsh, 2019). While Falk (2011) has taken a pragmatic approach in his work on visitor motivations and identity, and I agree with his assertion that knowledge is gained through action and must be useful for practice, I challenge his interpretation of pragmatism as an a-theoretical, a-methodological approach where anything goes as long as the means meet the ends.

In fact, pragmatism strongly informs a constructivist and interpretivist approach to research, whilst avoiding slipping into abject relativism (Bryant, 2017).

Rather than using a methodology based in unreflexive intuition, I propose a *practice-oriented* approach, founded in pragmatism's conception of knowledge and action as co-constituted, which I have used to support choice-making throughout the present research. Practice orientation goes some way to answering the questions *research for whom? Research to what end?* As such, practice orientation is an ethical commitment towards the subjects or participants of research, in this case the *Invisible Worlds* exhibition team at the Eden Project. This leads to research *with* and *for* science communication practice, rather than simply about practice. Being supported by the Eden Project, this research presented an unusual level of access and an ideal opportunity to work closely with an exhibition team during the production process, making such a practice orientation the logical choice for this research. It is important to note, however, that this is not the only orientation that could have been chosen. For example, the work of Emily Dawson takes an approach, which is strongly oriented towards social justice and the interests of minority ethnic audiences and non-audiences of science communication (Dawson, 2014).

To support a practice orientation, I have developed the methodological concept of *usefulness* as part of a normative, utilitarian ethical commitment to research impact. I define usefulness as a property of understanding gained through research, which helps actors to make decisions, or to do things. This concept is drawn directly from pragmatism's preoccupation with the co-constitution of knowledge and action (Dewey, 1930). Useful understanding in this sense creates, intersects or segments social worlds and makes material and discursive change within them, bringing actors into what James referred to as 'satisfactory relations' with one another (James, 1907, p.23). Choices between always provisional rival understandings are judged by their ability to produce desired outcomes (Teddlie and Tashakkori, 2009), being repeatedly re-assessed against new data as suggestions which only retain their status as long as they are useful (Clarke, Friese and Washburn, 2017).

Bryant (2017) developed this idea using a metaphor of understandings as tools or instruments. We can use a tool to see how well it achieves an intended outcome, but its usefulness will always be provisional and contextual. A tool can be useful for one job, and may be useful for others, subject to testing. We have to try things to see if they work. Bryant (2017) distils this metaphor into a useful heuristic he calls the *so what?* principle. Theories are judged on their utility as 'enacted truth' - if an assertion has no potential to impact on existing practical understanding or action, it is not useful. This concept has been applied in the present research by considering the pragmatic collapsing of the distinction between knowledge and useful everyday action (Corbin and Strauss, 2015). Different types of knowledge (for example theoretical, common sense, practical wisdom) form a non-hierarchical web whose value is their usefulness and applicability in time and space, by different actors within and between social worlds (Bryant, 2017). Where the research process has presented a choice between different potential theoretical understandings, these have been explored and modified in iterative reflection with practice and judged on their potential usefulness to effect or provoke change (Goldkuhl, 2012). For example, useful understandings in the context of the present study could empower institutions to make strategic decisions or act in ways they were previously unable to (for example through gaining legitimacy or funding), empower practitioners to reflexively develop their practice, or create opportunities for publics to engage with science on their own terms.

In this section, I have outlined the theoretical foundations of the present research, taking a starting point from Bauman's ideas on liquid modernity and contemporary ideas of communicative constructivism, and a research framework founded in a *practice-oriented* and *useful* interpretation of pragmatism. In the following section, I outline how the present research applied this framework by combining action research and grounded theory approaches.

3.2 Action Research

The present research draws on action research as a methodology which blurs the boundary between researcher and participant by actively involving participants in a

process of democratic knowledge creation (Bradbury, 2015; Greenwood and Levin, 2007). In general, action research is a methodology, which is differentiated from conventional social research by its concern with axiology over epistemology or ontology. In contrast to conventional social research, rather than asking what is, we must ask what is the right course of action (Argyris, Putnam and McLain Smith, 1985)? This kind of practical deliberation, which explicitly intends to impact people's lives, brings values into play and is inherently normative (Argyris, Putnam and McLain Smith, 1985). Action research, therefore, necessitates a normative axiological stance – a commitment to democratic and ethical relations between researcher and participants, and integration between theory and practice.

Despite the seemingly growing popularity of action research, a comprehensive overview of the methodology is hard to find or piece together (Greenwood and Levin, 2007). In general, action research treads a fine line between a post-modern ontology and epistemology of multiplicity and emergence, alongside a rather more modern drive to create positive change in the 'real' world (Coleman, 2015). This worldview shares much in common with the ideas about late modernity described in Section 3.1, and is compatible with transformative learning theory's hope for positive change in an ever-changing world. Nevertheless, the field has evolved disparately across multiple non-overlapping disciplines, resulting in a huge proliferation of variants with multiple, often contradictory, methodological groundings. Rather than try to comprehensively detail the many variants here, I provide a summary of arguably the most general methodological treatment of action research as outlined by Greenwood and Levin (2007), before detailing one approach, action science, which is most congruent with the theoretical framework outlined above, and which has most influenced the present research.

Greenwood and Levin (2007) outline action research as a collaborative way of doing social research that is rigorous while at the same time promoting democratic social change. Importantly, they are clear to assert that action research is engaged in solving problems through research, not just investigating them (Greenwood and Levin, 2007), by holistically combining action, reflection, theory and practice

(Bradbury, 2015). In short, they provide a framework of three key components defining action research:

1. Action – Action research must include action of some kind, which allows 'liberation through self-realisation', or at least a more satisfying situation for the participants involved. In this project, the action consisted of the development of the *Invisible Worlds* exhibition, as well as facilitated individual and group reflection-on-action (Schön, 1991) to support reflective practice.

2. Research – Generating new research knowledge, such as theories, models, methods, analysis. The present research created generative theoretical insights through long-term, in-depth, and iterative engagement with practitioners and practice, using a range of qualitative methods.

3. Participation – Control over one's situation, where the researcher acts as a facilitator, collaboratively generating the research agenda and knowledge. Participants' involvement can exist on a spectrum from consultation to being full co-researchers (Bradbury, 2015). This PhD research used a range of methods that allowed the *Invisible Worlds* team to shape the research agenda from the framing of the research questions to reflective discussion of theoretical concepts created through the research. Facilitated reflection-on-action gave participants the opportunity to reflect on their practice experiences, allowing them to apprehend and discuss pertinent issues and gain awareness of tacit processes and understandings guiding their practice.

Drawing heavily on Dewey's pragmatic philosophy, Greenwood and Levin (2007) critique rational choice theories as reductive and individualistic, instead taking an interconnected and holistic worldview which is compatible with the emerging relational and ecological approach to science communication indicated in Section 2.1, as well as the methodological foundations discussed earlier in this chapter. This pragmatic approach sees knowledge as co-created, and research as a process of *knowing with*, rather than *knowing about*. Practically, this means engaging stakeholders in defining research problems, and building webs of collaboration, rather than trying to socially engineer change (Bradbury, 2015). This means that, and

challenging conventional conceptions of science communication, knowledge is not separable into discrete, identifiable units of information or intellectual capital, but is embedded in processes and communities of practice (Coleman, 2015). This also means that while it is an axiologically normative methodology, it is not normative in terms of its possible outcomes or impact.

Analogous to Law's discussion of multiplicity (see Section 3.1), Greenwood and Levin (2007) assert that situations contain more possibilities than can be enacted i.e. things could have been different, and that the way things are is a combination of material and social processes and realities. This epistemology of multiplicity, emergence, and partial and conflicting truths underscores the commitment of action research to collaboration (Coleman, 2015) and an emergent process, which attempts to remove barriers to collaboration by understanding participants' complex and interconnected worlds (Bradbury, 2015). Action research contributes by explicating future possibilities and suggests how people might work together to create change (Gergen and Gergen, 2015). The important consequence of this is that theory cannot be predictive, but is instead explanatory, helping us to understand how things happened and giving us good reasons to believe in probable futures. Using explanatory theory, it is possible to take situatedness into account, whilst also developing understanding and explanation of processes which happen in other situations (Greenwood and Levin, 2007).

Due to working closely with professional exhibition development staff at the Eden Project, the present research is particularly influenced by a variation of action research called action science (Argyris, Putnam and McLain Smith, 1985), which was developed primarily by Chris Argyris, building on his work alongside Donald Schön on organisational learning and professional reflective practice (Argyris, 1983; Argyris and Schön, 1989). Drawing on Kurt Lewin's foundational action research principles, action science was developed in part to address contemporary critiques that action research was unscientific by emphasising rigour and theory development, whilst still challenging the status quo (Argyris, 1983; Friedman and Rogers, 2009). While Lewin never codified his approach, Argyris and colleagues (1985) interpreted its key components as follows:

- Experimenting on real problems in real systems.
- Cycling iteratively between problem identification, planning, acting, and evaluating.
- Changing norms and values.
- Democratically challenging the status quo.
- Contributing to both basic knowledge and social action.

Lewin's key components of action research provide an interesting counterpoint to those outlined by Greenwood and Levin, and suggest how action research has developed since its inception. While there are many points of similarity, the most obvious differences are a broadening from an experimental approach, to one of broad-based inquiry, as well as a more recent explicit emphasis on participation in research. Implied is also a development in understanding of the status and types of knowledge co-produced by action research. While Agyris and colleagues' interpretation of Lewin's approach displayed some traces of a developing constructivist epistemology, they still hold on to vestiges of objectivism by favouring generation of disconfirmable propositional theory (Argyris, Putnam and McLain Smith, 1985), and an arguably artificial separation between intention and action, interpretation and data (Argyris and Schön, 1989). While a contrast between intended and actual action may provide useful insight into the relationship between theory and practice (Coleman, 2015) it is questionable to what degree it is actually possible to enact these separations. Nevertheless, the core implication is that to encourage change in practice it is necessary for action research to be credible and for participants to have a stake in the research – principles which still hold today.

Action science, then, using Lewin's principles as a basis, was designed as a form of inquiry into how people design and implement action in relation to one another (Argyris, Putnam and McLain Smith, 1985). It consists of the creation of a community of inquiry within an existing community of practice through a process of public reflection, which produces credible knowledge by way of internal criticism of the community's own practices (Argyris, Putnam and McLain Smith, 1985; McLain Smith,

2015). This approach produces knowledge and theory, which is qualitatively different to conventional social theory in a way which begins to operationalise the usefulness criterion described above. Action science theory, as outlined by Argyris and colleagues (Argyris, Putnam and McLain Smith, 1985), should identify factors that can be manipulated by real people to bring about change – theory comes *from* practice (McLain Smith, 2015). Operationally, this means creating human-level theory, selecting a manageable number of important factors from the boundless complexity of practice, and appreciating that in reality, the level of control needed to hold variables constant is rare. Theory should rather help practitioners grasp complex issues of practice, be useful across a range of situations, help identify and frame problems as well as solve them, and lend itself to testing and application in the 'real' world.

This kind of theory, and the knowledge created from it, is less interested in scientific precision, which artificially fragments reality and assumes or imposes unilateral control over a situation, than with practical competence and social justice (Argyris, Putnam and McLain Smith, 1985). MacLain Smith (2015) has taken this idea even further by suggesting that even the traditional separation in action science between intention and action can be collapsed; rather than promoting organisational learning through resolution (Argyris, 1983), they can instead co-exist in a critical dialectic which can produce more integrated understanding. Following the principles of action science, then, the present research built in opportunities for the *Invisible Worlds* team to control and reflect on aspects of the research, to facilitate learning about their visitors, themselves, and their practice. Working 'hypotheses' in the form of putative conceptual categories were openly and publicly explored, allowing for individuality and expression of disagreement, respecting ideas, feelings and different types of knowledge (Argyris and Schön, 1974), whilst pragmatically accepting that in practice only one course of action or line of inquiry may be possible.

In practice and in research, decisions and actions must be made with incomplete evidence, in limited timeframes and without complete consensus. Practice requires that knowledge is optimally incomplete (Argyris, Putnam and McLain Smith, 1985) – there is enough information for real people to be able to make use of it to grasp

complex problems as *Gestalt* in real time, whilst being open to further elaboration as needed. Necessarily, the process of action science selects things to attend to whilst ignoring others. In being selective, interpretation and values, again, come into play. In any situation, especially those which are highly collaborative as in action research, there may be multiple conflicting research 'goods' (Gergen and Gergen, 2015), not least those of truth, politics, usefulness, and practice orientation already outlined in this chapter. While conflicting interests may not be resolved, this dilemma re-iterates the need to reflect on axiology, as explored above.

In summary, action research methodology was used in the present research as a way to render explicit the tacit processes of exhibition practice (Argyris, 1983; Argyris and Schön, 1974), so that they might be reflected upon and critiqued, to promote organisational learning by examining intent and outcome (Argyris, 1983) and encourage changes in practice through individual practitioner reflection and transformation (Cranton, 2013).

3.3 Grounded Theory

While action research was selected as the underlying methodology of the present research, beyond its focus on axiology it is in general non-prescriptive with regards to how research should be conducted in terms of both method and analysis. While allowing for innovation and emergence in the field, this non-prescriptiveness threatened to undermine the rigour of the research, particularly as a novice researcher with limited research experience. To support the action research methodology, a complementary methodology, grounded theory, was selected and integrated with action research.

Grounded theory was developed by Bernie Glaser and Anselm Strauss as one of the first attempts to codify and bring rigour to qualitative methodology (Glaser and Strauss, 1967). They characterised their original approach as a critique of contemporary social research, which until then had prioritised theory verification over theory development. Perhaps controversially, Glaser and Strauss were untroubled by the factual accuracy of theory and the need to generate large data samples. Instead, they argued that their concern was with explanation of facts, not

their verification. They argued that theory was based on abstract concepts, not facts alone, and that such concepts can be useful theoretical abstractions, even if the facts change and some modification becomes necessary. In the words of Glaser and Strauss (1967, p.24), a concept 'lives on' until it is no longer useful for explaining *any* data. As an example, the deficit model concept has gone on to have quite an extended life of its own, far beyond what Brian Wynne may have imagined in the late 1980s, despite it not being an 'effective' or 'accurate' model of science communication. Likewise, only a single case is needed to justify the generation of a concept. Arguably such a concept might have quite a limited 'life' beyond its initial context, but nevertheless the point Glaser and Strauss made is that the aim of grounded theory is not to perfectly describe a situation, but to develop an abstract theory which takes into consideration that which is most relevant.

Although couched in the objectivist language of discovery, the aim of grounded theory, then, was to generate concepts and hypotheses that are relevant to a substantive research area (Glaser and Strauss, 1967). This aim was achieved through a rigorous process of comparative analysis and theoretical sampling. While many introductory texts on grounded theory describe various methods of coding in grounded theory at length (Charmaz, 2014; Corbin and Strauss, 2015), coding is by no means unique to grounded theory, nor definitive or even requisite. Adele Clarke's postmodern update of grounded theory, situational analysis (Clarke, Friese and Washburn, 2017), for example, eschews coding for mapping while losing none of the methodology's character. Clarke instead identifies theoretical sampling as perhaps the one unique feature of the grounded theory approach (Clarke, Friese and Washburn, 2017). Arguably, comparative analysis, while not unique to grounded theory, is another indispensable aspect of the method.

While comparative analysis in itself was not innovative, Glaser and Strauss (1967) extended it from comparison between relatively large social units (e.g. different organisations) to a general method of comparison between units of any size or level of abstraction. This comparative method was later clarified by Juliette Corbin, who outlined two main types of comparison (Corbin and Strauss, 2015). Firstly, constant comparison is used to compare manageable chunks of data to other data, identifying

conceptual similarities and differences. As analysis progresses and these chunks of data are grouped into categories and given labels called codes, the category itself can be compared to data, allowing it to be refined to better match the empirical reality (Corbin and Strauss, 2015; Strauss, 1987). Second, theoretical comparison is an imaginative analytical exercise, comparing a developed concept with another imagined scenario to consider alternative interpretations (Corbin and Strauss, 2015). Such comparison may even involve micro-analysis of the meanings of individual words (Strauss and Corbin, 1998).

As these comparisons continue, theoretical sampling is used to generate more data for further comparison. Theoretical sampling consists of simultaneous data collection, coding and memo writing, where decisions over what data to collect next are made with respect to the developing theory (Glaser and Strauss, 1967). This method of sampling is a radical departure from randomised or statistical sampling methods, but logically follows on from Glaser and Strauss' argument about the level of accuracy and volume of data needed to develop new concepts (Glaser and Strauss, 1967). Grounded theory does not aim for conceptual saturation through the identification of the maximal number of categories or concepts, collecting data until no new themes can be identified, as in conventional non-theory-building methods such as thematic analysis (e.g. Braun and Clarke, 2006). Instead, the aim is for *theoretical* saturation through the maximal development of a limited number of concepts. As such, in grounded theory, the emphasis is not on representativeness in order to accurately describe a population, but on sampling examples of concepts to comprehensively specify them.

Since being originally developed, grounded theory has grown in popularity as a qualitative methodology and has undergone several subsequent developments. There now exist multiple variants of grounded theory methodology, all of which bear a family resemblance to Glaser and Strauss' original vision, whilst having contrasting and often vociferously defended epistemological differences. Most notably, Glaser and Strauss individually took the methodology in very different directions; while Glaser maintained the language of discovery and a largely a-theoretical position which has been described by some as 'objectivist' (Charmaz, 2000). Strauss,

alongside his student and colleague Juliette Corbin, developed grounded theory by emphasising its pragmatic and symbolic interactionist influences (Corbin and Strauss, 2015). Latterly, grounded theory has been developed further by Kathy Charmaz, taking an explicitly constructivist stance (Charmaz, 2014), while Adele Clarke, as previously mentioned, has re-formulated grounded theory ideas for post-modern and interpretive times, creating situational analysis (Clarke, Friese and Washburn, 2017). In line with the methodological foundations outlined in this chapter so far, the present study finds most resonance with constructivist grounded theory.

Relevant aspects of pragmatist philosophy have already been outlined in this chapter, so rather than repeating those here, it suffices to say that grounded theory shares the same pragmatic basis detailed above (Bryant, 2017; Charmaz, 2014; Corbin and Strauss, 2015). A new perspective which grounded theory brings, however, is that of symbolic interactionism. While the present research does not tie itself to a strongly symbolic interactionist position, the interactionist influences on grounded theory methodology are apparent and worth considering in terms of how they have shaped the methodology and the kinds of questions that can be addressed using it. This is especially the case as symbolic interactionist thought forms much of the basis of a constructivist epistemology (Knoblauch, 2019).

The term symbolic interactionism was coined by Herbert Blumer in his sociological psychology, based on three key premises (Blumer, 1969):

- People act based on the meanings things have for them.
- People derive meaning from social action.
- People create meaning through a process of interpretation.

One of the key consequences of Blumer's symbolic interactionism is that social interaction is not just an expression of meaning, but also forms meaning (Blumer, 1969). What this implies is that people make decisions on how to act based on social interaction, rather than previously held attitudes, values, or motivations (Charmaz, Harris and Irvine, 2018). For example, in the context of the present research, this means that visiting an exhibition is not just a straightforward expression of needs or

motivations, but visiting a museum also forms needs and motivations through interaction and interpretation. Blumer was a student of George Herbert Mead, and was strongly influenced by his social behaviourist ideas around the development of the self (Mead, 1934). More recently, Charmaz (2014) has interpreted Mead's influence on grounded theory in the links made between consciousness and the self, and assumption of process over stability. Symbolic interactionism is also canonically influenced by Charles Horton Cooley's (Cooley, 1902) conception of the looking-glass self – that people act based on an imaginary image of how they believe others see them. In short, symbolic interactionism concerns itself with how people interpret social interaction to give meaning to objects and events (Charmaz, Harris and Irvine, 2018), including themselves and others.

More recently, Charmaz, Harris and Irvine (2018) have updated Blumer's premises to account for more contemporary interpretations of symbolic interactionism, which expand on the interpretive process through which meanings are constructed. These are as follows:

- People interpret meaning through language and communication.
- People are continually engaged in a process of negotiating meanings.
- People's interpretive processes only become explicit when meanings or actions become problematic or situations change.

Charmaz, Harris and Irvine (2018), based on these premises, stress that symbolic interactionism is not an explanatory theory; it cannot be used to specify precise variables or predict certain outcomes. Rather, symbolic interactionism is a perspective (Charmaz, Harris and Irvine, 2018; Charon, 1995) it is a way of making sense of the relationship between individuals and society through how people construct and negotiate meaning in everyday life (Charmaz, Harris and Irvine, 2018). Drawing on the discussion of pragmatism above, we can say that symbolic interactionism, as a way of thinking about the relationship between individuals and society may be a useful tool for the purposes of the present research, but, it is nevertheless only one tool of many which may be adopted in research to address

different problems. As such, symbolic interactionism is suited to answering certain types of questions about the social world (Charmaz, Harris and Irvine, 2018):

- In what kinds of social interactions are people involved?
- How do social interactions affect how people identify themselves and others?
- How do people define the situations they find themselves in?
- How do people explain their actions?
- How do people's actions influence the meanings they attribute to what they are doing?

These questions all come from an emic perspective, attempting to understand and explain the social world from participants' perspectives.

As already alluded to, one of the most important concepts in symbolic interactionism, shared with transformative learning, is identity. While the self in symbolic interactionism is seen as processual (Charmaz, 2014), identity is a more stable object consisting of the names we call ourselves; Identity is our social location in relation to others (Charon, 1995). Identities may be 'central' and resistant to change, while others may be peripheral and more malleable. In general, though, symbolic interactionism sees identities as constructed, reaffirmed and changed though social interaction (Charon, 1995). In transformative learning, Illeris (2014a) defines identity similarly as concerning the connection between the individual and their surroundings, with core and more peripheral identities, which may be more or less easily changed. Illeris extends this definition of identity into the phenomenological realm to include the experience of feeling like the same person and being perceived as the same person in different contexts. In terms of symbolic interactionism, this corresponds with a continuity in social location and relations over time. It follows that transformation, the main theoretical focus of the present research, may be seen as a dis-continuity in social location and relations, particularly those which are generally more resistant to change (Illeris, 2014a). As Illeris (2014a) has argued, in liquid

modernity, this process of identity change is necessary to be able to make sense of a fluid and fragmented world.

Interestingly, in his work on visitor motivation, Falk (2009) constructs a definition of identity, which is not dissimilar to that put forward by symbolic interactionism. However, the main point of disjuncture is that while symbolic interactionism makes no claim to explanation or causality, for Falk, identity causes certain behaviours and actions in a predictable way. In contrast, the present research makes no such claims, instead leaving room for emergence, human agency and creativity (Charmaz, Harris and Irvine, 2018). This difference is not simply ideological, but follows from the perspective of symbolic interactionism that meanings are continually negotiated in light of interaction, that identities can have different meanings to different people, and that these meanings can change over time. For example, Falk (2009 : p.195) cites one visitor identity as the 'good parent' who acts as a facilitator to their children. Rather than seeing being a good parent as a static entity universal to all people which predicts certain behaviours, using a symbolic interactionist lens allows us to consider how being a good parent may mean different things to different people in different situations and at different times. Likewise, symbolic interactionism allows us to consider how a person's conception of being a good parent might change as a result of visiting a museum. This perspective is important to the present research for two reasons. Firstly, while previous approaches have attempted to create predictive theory, they have also tended to sort visitor behaviour into discrete categories (Dawson and Jensen, 2011). Recent research by Emily Dawson (2014, 2018) has suggested that by so doing, science communication becomes exclusive and discriminatory, excluding those whose behaviour does not fit into pre-concieved notions of 'the visitor'. Secondly, by focusing on transformation as a sensitising concept, the present research is interested in how visiting an exhibition changes people, as well as how an institution might be changed through producing an exhibition. A symbolic interactionist position allows the consideration of diverse and changing identities over time, providing a different, explanatory, rather than predictive perspective, on the visitor experience and exhibition practice.

Having briefly outlined grounded theory and symbolic interactionism, I will now detail Kathy Charmaz's (2014) constructivist interpretation of grounded theory, which was used in the present research. Responding to critiques that grounded theory represented a modernist epistemology, which fragmented data, imposed researcher authority, and ignored diversity, Charmaz attempted to re-frame the basic strategies of coding, memo-writing, theoretical sampling, and comparative methods, for a social constructivist epistemology, firmly rooted in the constructivist turn of the 1990s. Herself critiquing contemporary social constructivist research, Charmaz emphasised that just as the world we study is socially constructed, so is the research itself. This highlights a need for the researcher to be reflexive about their own actions and decisions. In constructivist grounded theory there is no neutral or value-free observer, quite in opposition to Glaser and Strauss's (1967) original conception of the researcher entering the field without preconceptions.

In grounded theory generally the emphasis of analysis is on developing theory. Charmaz (2014) strongly re-asserts this point, defining theory as being constructed through the explication of abstract concepts, supported by theoretical sampling. Importantly, simply conducting an iterative, inductive research process is not sufficient – the concepts developed must be sufficiently abstract to travel beyond their substantive context. As one example, Charmaz cites the concept of *temporal emotions*, developed by Jennifer Lois (2010) in a study of the experiences of homeschooling mothers. Lois developed the concept, which encompasses emotions such as hope and regret, as a tool which the mothers manipulated to manage their emotional difficulties while negotiating the 'time-sensitive identity' of motherhood. Charmaz highlights Lois' work as a theoretical contribution, which has sufficient abstraction to be transferred to other situations.

As discussed in the literature review, while the deficit model concept, for example, has been influential, and there has been an evolution of discourse and language around engagement, dialogue, and participation, the enduring focus on direction of communication evidences that there has been little change in the conceptual toolkit we have available to analyse and understand science communication as a phenomenon. While there are some promising concepts and perspectives, which

were outlined in the literature review, such as newer ecological approaches, these tend towards the application of deductive theory, or use or modification of existing theory, rather than the inductive generation of new theoretical concepts from empirical experience, native to science communication. While the present research takes science communication theory, transformation and transformative learning theory as starting points, it nevertheless takes an explicitly inductive approach. In keeping with grounded theory methodology, it does not tie itself to these theoretical ideas, but instead sees these as sensitising concepts, conceptual tools which enhance theoretical sensitivity and allow the theoretical concepts generated to be situated within their wider theoretical context. Rather than seeing these theoretical ideas as being discovered, either inherent in social reality or data, through grounded theory methodology, they are constructed 'through our past and present involvements and interactions with people, perspective and research practices' (Charmaz, 2014, p.17).

In line with the methodology's roots in pragmatism, rather than listing abstract principles of grounded theory, Charmaz (2014) explicates the methodology through the actions a grounded theory researcher does:

- Generate and analyse data simultaneously and iteratively.
- Analyse actions and processes, not themes or structure.
- Use comparative methods.
- Develop new concepts using data.
- Develop abstract analytical categories through inductive and systematic analysis of data.
- Construct theory, rather than describe or analyse existing theory.
- Do theoretical sampling.
- Search for variation.
- Develop a theoretical category, rather than cover a specific empirical topic.

Charmaz (2014) argues that the first five actions are commonly carried out, but that a fully grounded theory study must do all of them. The final four actions all constitute the activities of theory development, which goes beyond developing abstract analytical categories from data, such as might be developed through thematic analysis (Braun and Clarke, 2006).

However, even Charmaz admits that what the term theory means in both grounded theory and the social sciences more widely is ambiguous and depends on a researcher's epistemological positioning (Charmaz, 2014). Following the methodological discussion above, some assertions could be drawn about theory needing to focus on context, explanation, and process but even these terms remain vague without further specification. A useful entry point to this discussion is Varipo and colleagues' (2020 p.990) concise definition of theory as 'an abstract description of the relationships between concepts that help us to understand the world'. While brief, Varipo and colleagues succinctly identify a key criterion, which distinguishes theory development from the development of abstract analytical categories – theory concerns itself with how such categories are related to one another. Charmaz (2014) calls this the *why* – inspecting the relationship between what people do and how they do it to determine why subsequent actions and events occur. Following this relational interpretation of theory, we can specify context, for example, as the relations between actors (Irwin and Michael, 2003). Similarly, theory which is explanatory can be seen as specifying the relations between phenomena (Varpio et al., 2020). It follows that theory, which focuses on process, seeks to understand how relations are created, maintained, changed or broken over time. This understanding of theory finds its roots in Glaser and Strauss' foundational work, where they described theory very practically as a strategy for making use of data. Revealing the links to pragmatism outlined above, such a kind of theory, they argued, should be practically usable, fitting the substantive situation and working when put into use. Again, these criteria of theory have a relational character, *fit* specifying a close relationship between data and theoretical categories, and *work* specifying a relevant and explanatory relationship between theory and the research context. In practice, relational elaboration is achieved in grounded theory through theoretical sampling

and exploration of variation through comparative analysis, compared to random sampling approaches, which aim for conceptual, rather than theoretical, elaboration. Specification and clarification of relations between actors and phenomena over time provides theory that rather than being predictive, provides an interpretive frame through which to view reality (Alasuutari, 1996). This kind of theory is generative (Gergen, 1978), giving us new conceptual tools with which to see and act in the world.

In summary, grounded theory is a methodology based on pragmatism and symbolic interaction, which, through iteration and theoretical sampling, allows for the generation of primarily emic and generative theoretical insight through the elaboration and specification of abstract analytical concepts (actors, phenomena etc.) and their relations over time. In the following section, I further detail how action research and grounded theory have been combined in the present study.

3.4 Grounded Reflection: Combining Action Research and Grounded Theory

The present research is not unique in combining action research with grounded theory. In fact, the two approaches are often combined because grounded theory offers clear specifics of analysis and theory where action research does not. By 'filling in the blanks' of action research, the addition of grounded theory is typically seen to improve the rigor of action research (Dick, 2007). Arguably therefore, the most common approach is to use grounded theory techniques to enrich an action research framework. Nevertheless, other approaches are also used which reflect the level of integration between the two methodologies.

Offering the closest integration between the two methodologies, Dick (2007) critiqued evidence-based practice for oversimplifying cause and effect which results in theory driving practice. Instead, he suggested that grounded theory and action research together are better suited to the complex problems of practice, and that we should instead be valuing evidence-based theory. Dick's argument is based on the premise that each methodology may counterbalance the weaknesses of the other (Dick, Stringer and Huxham, 2009), with grounded theory making action research

more explicit about theory development, and action research making grounded theory more participatory, action-focused and economical with data. Others have taken one methodology as primary, using the other to supplement and address weaknesses. In these cases, grounded theory analytical techniques might be used, for example, to add rigour to theory development in action research (Baskerville and Pries-Heje, 1999), or a grounded theory approach might be supplemented with action research methods to increase the validity of the generated theory (Teram, Schachter and Stalker, 2005).

A phased approach to combination is most common (with notable exceptions – Baskerville and Pries-Heje, 1999; Dick, 2007), with the most prominent example being the work of Simmons and Gregory (2005) which they call 'grounded action'. The distinctive feature of grounded action is that two theories are developed. First, an explanatory theory is developed which bears a strong resemblance to a typical grounded theory analysis. Second, an operational theory is developed from the explanatory theory, which addresses a particular 'action problem' and is used for action planning and implementation (for example program design, policies, procedures). The operational theory re-interprets the action problem in light of the explanatory theory, accounting for each of its properties and dimensions (Simmons and Gregory, 2005). Similar phased approaches generate an initial grounded theory which is then modified in response to later action research phases (Butterfield, 2009; Teram, Schachter and Stalker, 2005), but do not separate explanatory and operational theories.

Nevertheless, in each case, it is the grounded theory, which is given primacy both conceptually and in the sequencing of the research. Teram and colleagues (2005) emphatically argue the case for this approach in that basing action research on grounded theory allows researchers to fully leverage their professional credibility and resources, recognizing the power differentials between participants and a professional community, which the research may be trying to persuade. They suggest that the reduced credibility of a purely action research (in their case, participatory action research) approach may hinder the aim of trying to represent participant groups (Teram, Schachter and Stalker, 2005). Teram and colleagues

(2005) take quite a critical stance towards ideologically driven action research, but at the same time highlight the importance of how axiology may shape action research in practice – in this case how placing value on professional credibility motivated a primary grounded theory approach followed by a secondary action research phase. This stance illustrates how, in action research, a declarative approach to axiology is necessary (Redman-MacLaren and Mills, 2015), as has been attempted in earlier sections of this chapter.

The present research takes an integrated approach to combining action research and grounded theory, with little, if any distinction between separate phases of grounded theory or action research. The reason for this is that, given the practice-oriented commitment of the research, it made sense to include Eden Project staff in the agenda-setting process using a modified Delphi process (described in detail in the following chapter). Including staff from the outset meant they had a stake in the results and outcomes of the research. Nevertheless, analysis was not participatory but rather data were analysed solely by the researcher to lend academic credibility to the findings. With that said, with the commitment to usefulness, the ongoing analysis was regularly presented to the participants for reflective discussion, which generated further data and allowed the developing theory to be refined in a way which was useful for practice. Overall, emphasis was placed on using research evidence for facilitated reflective discussion – ‘grounded reflection’.

3.5 A Note on Ethics

Axiology, which encompasses ethics, has already been discussed at length in this chapter. I have outlined, for example, the concepts of practice-orientation and usefulness which have guided the present research. Nevertheless, action research of any kind requires close collaboration with participants, which means the risk posed to Eden project staff and their collaborators needed to be carefully considered and managed. The action of action research can be both threatening, causing fear and anxiety, and political, with consequences which may harm participants (Meyer, 1993). However, due to the in-depth collaboration and evolving nature of the research, total anonymity, informed consent and withdrawal without consequence

can rarely be guaranteed; normal ethical codes cannot adequately cover every situation that may arise (Williamson and Prosser, 2002). The solution to managing this risk is in genuine collaboration, where the participants own the research findings as much as the researcher (Williamson and Prosser, 2002), using the principle of reflexivity to rebalance the researcher-participant relationship (Etherington, 2007). Participants question and interrogate the research in a process of reflection and negotiation (Clark and Sharf, 2007) so the responsibility for the findings, political and organisational consequences are shared between all parties (Williamson and Prosser, 2002). Despite this, the researcher also has a duty to protect the participants, and must be willing to accept personal and professional responsibility for potential harm, sheltering less powerful participants, such as subordinates, where necessary (Williamson and Prosser, 2002).

With these considerations in mind, an ethics application was made to the University of the West of England's ethical review procedure, and was approved with the reference number HAS.17.04.146.

3.6 Chapter Summary

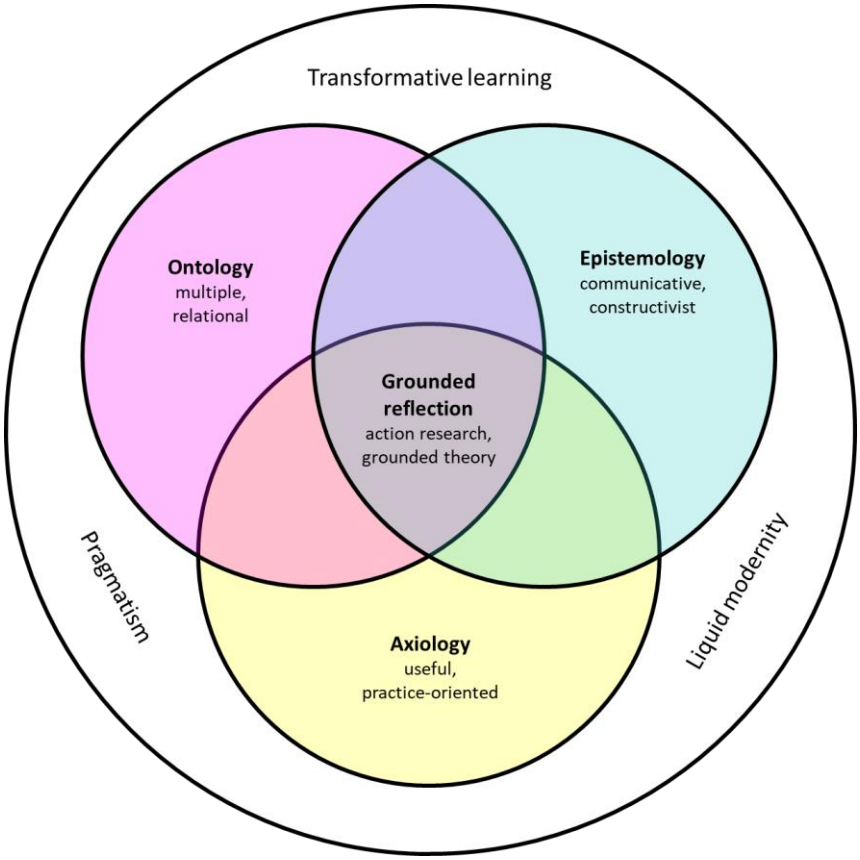


Figure 3 A summary of the methodological framework 'grounded reflection'.

This chapter has explained the ontological, epistemological and axiological underpinnings of the present research, as well as the general methodological framework of 'grounded reflection' as a combination of constructivist grounded theory and action research. Figure 3 summarises the approach, showing how grounded reflection is motivated by ideas of transformative learning, pragmatism and liquid modernity. Having laid the groundwork, the following chapters explain how this methodology was practically applied in the present research.

4 Organisational Data Generation and Analysis

This chapter gives details about the section of the action research which generated data around the production of *Invisible Worlds*. The results of a Delphi process are presented, which was conducted to establish a group understanding of the concept of transformation, as well as to elaborate the research questions introduced in Section 2.4. This chapter also discusses how, using grounded theory procedures, the data were analysed.

4.1 Sampling Strategies and the Critical Reference Group

Little attention has been given to sampling in the action research literature. This is likely because action research does not operate under the positivistic paradigm of drawing statistically representative random samples from a larger population. The aim is not to statistically generalise, but to focus on a specific group's most pressing issues and concerns (Cunningham, 1983; Dexheimer Pharris and Pilsbury Pavlish, 2014). As such, the idea of a 'sample' makes little sense. Instead, it may make more sense to talk about the participants in terms of a 'critical reference group' (Wadsworth, 1997), comprised of those affected by the problem in question and who have the power to make change (Dexheimer Pharris and Pilsbury Pavlish, 2014).

Because action research is situated in a specific time and place, and the research aims to include those who best understand the problem (Cunningham, 1983), the choice of participants is restricted, and in many ways, the sample 'presents itself' (Suter, 2012, p.242). Those who participate are those with the most stake in the problem – how it is labelled, known about, represented and understood (Genat, 2009). In this way, this approach to recruitment bears similarity to key informant sampling and snowball sampling. However, while the sample may at first seem unproblematic, continuous care must be taken to attend to who is part of the conversation and who is excluded (Dexheimer Pharris and Pilsbury Pavlish, 2014), as well as the politics and power which may influence participation. Participants' social positions in relation to others may lead them to exaggerate or minimise successes or failures and idealise or disparage themselves and others (Heckman et al., 1996).

Instead of seeing this as a critical failure of this type of sampling, reflecting on recruitment and participation offers an opportunity to elucidate social dynamics, which may enrich analysis (Noy, 2008).

The following sections outline the selection and participation of the critical reference group, as well as detailing the theoretical sampling strategy implemented in this part of the study.

4.1.1 Inclusion Criteria

The initial selection of Eden staff participants consisted of the '*Invisible Worlds* team'. These were the members of staff who were working most closely on the *Invisible Worlds* project, had an intimate understanding of its problems and successes, and the power to affect change within their own practice relating to *Invisible Worlds*. At the beginning of the Ph.D. project, the *Invisible Worlds* team were already working together and met fortnightly to update one another on their progress. Capitalising on this, participants were recruited from this regular meeting. Those who initially agreed to participate in the project were additionally asked and encouraged to invite whoever else they felt may be interested or may benefit from taking part. The minimum criteria for being able to take part were to be employed by the Eden Project working on *Invisible Worlds*, and willing to actively participate in a collaborative process throughout the duration of the project. External collaborators and contractors were excluded due to the ongoing and in-depth nature of the action research project, however, if they attended a meeting which was being observed, consent was obtained to observe their participation in the meeting, without any expectation of ongoing commitment.

4.1.2 Critical Reference Group Characteristics and Participation

During one of the fortnightly team meetings, I introduced the project and invited attendees to participate. The participants were given a detailed information sheet to read which outlined the commitment required to the project, as well as potential risks to participation. The approached employees were able to ask questions and discuss the project before deciding to take part. Participants were encouraged to engage

with the project as much as possible, but due to work and time commitments were able to freely opt in or out of each stage of the action research process, as well as being able to withdraw at any time. While it is not realistically possible to guarantee complete anonymity of the participants, they were able to choose varying levels of pseudonymisation, with most opting to disclose their job title, but be identified under a pseudonym.

During participant observation of the team meetings, external collaborators were at first required to complete the same consent process as for Eden Project staff. However, it became apparent that having to read and fill in a lengthy form unduly disturbed the meetings and was also confusing to participants whose involvement in the research was minimal. After an amendment to the ethics approval, verbal consent was obtained from participants who occasionally attended meetings but otherwise fell outside of the inclusion criteria for full participation.

After Phase 1, it became apparent that there were three 'levels' of participation:

1. Key participants – Those working most intensely and directly on *Invisible Worlds*, with a direct stake in the action research. The outcomes of the action research would directly affect their roles and practices. These people formed the critical reference group.

2. Peripheral Eden Project staff – Eden staff who occasionally engaged with the project, but either did not work as intensely on *Invisible Worlds* or only had limited participation in the action research.

3. Collaborators and contractors – External staff working on *Invisible Worlds* who occasionally attended observed meetings but did not actively participate in the research.

These levels informed the formation of the critical reference group. For full details of participation see Table 1. Collaborators and contractors were excluded from further participation, with the focus shifting to the key participants. While peripheral Eden Project staff were not excluded from participating in later stages of the research, and participants were encouraged to invite others who may be interested in the project

throughout, in practice the key participants almost exclusively formed the critical reference group and engaged with the later stages of the project.

Participant	Phase 1 Delphi Process				Phase 2 Repertory Grid Interview	Phase 3 Working Group Meetings		
Key 1	✔	✔	✔	✔	✔	✔	✔	✔
Key 2		✔	✔	✔		✔	✔	✔
Key 3	✔		✔	✔	✔	½	½	
Key 4	✔	✔	✔	✔			✔	
Key 5	✔	✔	✔	✔	✔	Leave of absence		
Key 6		✔		✔	✔	✔	Leave of absence	
Key 7	✔		✔		✔			
Peripheral 1			✔					
Peripheral 2				✔				
Peripheral 3							✔	
Peripheral 4								✔
Peripheral 5								✔
Peripheral 6								✔

Table 1 Participation of Eden Project staff throughout successive phases of the research. Note that while throughout the thesis staff are generally referred to by their job title, they are given a number here to preserve confidentiality.

Participants' active participation in the project was fairly mixed throughout. On average, the key participants engaged with five of eight 'steps' of the research, with only one participating in all of them. Two of the seven key participants withdrew from the research part way through due to leave of absence. A further three participants, while not formally withdrawing from the study, in effect withdrew because they stopped attending or engaging with the research. This drop off in participation reflected changing priorities and dissolution of the project team following the opening of the *Invisible Worlds* exhibition, leading to the working group meetings 'fizzling out' (McArdle, 2008).

McArdle (2008) discusses several signs that an action research group may be 'fizzling out', including difficult contact, proposing engagement outside the remit of

the project and dwindling participation. These formed ongoing challenges throughout the project, with participation being a continual negotiation between the researcher and the participants. For example, participants regularly proposed engaging with the project in ways outside of its remit, such as the opportunistic interviews detailed in Section 4.3.2. While proving to be analytically useful, these attempts could also be seen as defensive routines or attempts to undermine perceived threats associated with the group action research process (Argyris and Schön, 1974b), allowing some to speak whilst silencing others. Furthermore, participants leaving in the middle of meetings, continuous interruptions during meetings, and meetings being cancelled or postponed without notice limited the fostering of a trusted collaboration, which is vital for the success of action research. Finally, the discontinuity in participants disrupted the potential for participants' deeper reflection or learning from *Invisible Worlds* or the action research process itself. Ultimately, by the third of six planned working group meetings the attendees had changed markedly to the point where continuing reflection from the previous meetings made little sense and it became necessary to recap the entire research project, now at the end of its second year, from the beginning. At this point, it was decided to end the action research reflection (McArdle, 2008).

4.1.3 Theoretical Sampling

As the research progressed, sampling moved from the formation of the critical reference group to theoretical sampling. While the initial sampling strategy aided in selecting the critical reference group, grounded theory methodology necessitates the use of theoretical sampling as the analysis progresses, to generate further pertinent data to elaborate and refine theoretical categories (Charmaz, 2014). In constructivist grounded action a further aim was to facilitate successively deeper levels of reflection on the production of the *Invisible Worlds* exhibition and the generation of action or modifications to practice.

Theoretical ideas generated from the initial data in Phase 2 were further developed using three theoretical sampling strategies. First, with the focus on privileging the experience of the critical reference group (Genat, 2009), rather than seeking out

additional participants or research sites, examples of the developing concepts were 'sampled' from the existing participants using discussion prompts during working group meetings, to allow them to further elaborate and explicate their experience of developing the *Invisible Worlds* exhibition. The tentative categories were used as prompts during the working group meetings, which the participants were able to select to discuss, ensuring the developing analysis reflected and moved towards their matters of concern. Second, project documents, including meeting minutes and content documents, were sampled to elaborate the development of the *Invisible Worlds* project over time, re-emphasising the commitment to elucidate process through the analysis. Third, after further development of the conceptual categories, the initial data were 're-sampled' and re-interpreted within the developing theoretical framework.

4.2 Phase 1: Setting the Research Agenda

While I began the research process with some pre-specified ideas and questions from my grasp of the literature and my ideas from science communication practice, I was eager, based on my personal commitments to action research and improving practice, for the research to be directed by the *Invisible Worlds* team and their particular problems of practice. At the beginning of the action research process I did not know the team at all. I also became immediately aware that there was an apparent hierarchy within the team, with some more dominating and competing characters. To expedite the start of the research process, and based on these potentially challenging circumstances, I developed a modified Delphi process (Landeta, 2006; Seakins and Dillon, 2013), as a more structured and technical approach to generating the research agenda. Starting with the word 'transformation', we used the process to define this central sensitising concept, and to generate a pragmatic consensus around a question to direct the research. The following sections outline the Delphi process and analysis, leading to an elaboration of the central sensitising concept and generation of a sensitising research question.

4.2.1 Modified Delphi Process

Research on expert opinion in decision-making by the RAND corporation in the 1940s (Landeta, 2006) culminated in the development of the Delphi process (Dalkey and Helmer, 1963), named after the ancient Greek oracle of Delphi's predictive abilities (Kennedy, 2004). In this process, a group of 'experts' complete an open response questionnaire followed by successive rounds of closed questionnaires. By providing structured feedback on the results from the previous rounds, the process aims to form a prediction or set of priorities (Dalkey, 1972), while eliminating the effects of group interaction (Goodman, 1987). In its modern usage, the method no longer necessarily seeks consensus, but instead aims to obtain a group opinion (Landeta, 2006), generating discussion and enabling decisions representative of a group's views at one moment in time (Goodman, 1987).

The strength of the method is in providing a structure for group decision-making, while anonymity reduces group effects, giving participants equal weight (Kennedy, 2004; Landeta, 2006), particularly in hierarchical working environments (Williams and Webb, 1994). While consensus is not necessary, when a decision must be made, the Delphi method can un-intrusively guide a group to a final decision, whilst taking disagreement into account (Williams and Webb, 1994) Additionally, the process allows for extensive consideration of a given topic (Landeta, 2006), allowing views to be changed, removed or added after considered thought (Williams and Webb, 1994), rather than taking respondents' initial responses at face value. However, care must be taken by the researcher to not unduly influence the respondents through the choice or presentation of questions (Vernon, 2009). Even when a genuine consensus is achieved, it may not be plausible (Weaver, 1971), or could represent the lowest common denominator of opinion (Rennie, 1981). The anonymity of the process may reduce the accountability of the experts' responses (Becker and Bakal, 1970; Goodman, 1987; McKenna, 1994), reducing the process to a box-ticking exercise, rather than one which warrants serious consideration. Despite these limitations, in this study the Delphi processes ensured the research direction was identified and agreed upon by the *Invisible Worlds* team and was relevant to their practice (Williams and Webb, 1994).

In this project, the Delphi process followed Seakins and Dillon (2013), who used a similar process to develop research questions for a PhD project in a comparable context. To avoid unintentional manipulation during the process (Vernon, 2009; Williams and Webb, 1994), a protocol was established in advance with aims to generate a definition of transformation and a shortlist of research questions. The process consisted of four rounds:

1. *Group Discussion*. Typically, a Delphi process is carried out entirely via anonymous questionnaires. However, in this hybrid process following Seakins and Dillon (2013) a group discussion was used to elicit initial ideas, as well as establish buy-in for the research. Because of the collaborative nature of the action research approach used in this study, an initial face-to-face element was deemed necessary to develop a rapport between the researcher and project team. The discussion was designed to lead the project team to reflect on their personal definitions of 'transformation' as well as the questions they would like to investigate through the action research. The discussion began with a presentation about the action research project, followed by successive discussion prompts, taking the participants from the ideal and probable outcomes of *Invisible Worlds*, to more specific definition. At the end of the discussion, the team individually and anonymously wrote down and submitted their ideas, which formed the basis of the following questionnaire rounds.

2. *Questionnaire 1*. The written responses submitted at the end of the discussion were separated into individual definition statements and research questions, with identical or semantically similar responses being combined. These 44 statements and 23 research questions formed the basis of an online questionnaire, to be completed by the team. Participants rated each statement on a five-point Likert scale based on its importance and chose and ranked their top five research questions. Definition statements which were classified as having a consensus around being not important based on the criteria given in Table 2 were eliminated from the subsequent questionnaire rounds.

Classification	Definition Statements and Themes	Research Questions
Consensus	Inter-quartile Range 0-1	Inter-quartile Range 0-1
Contentious	Inter-quartile range 2-5	Interquartile Range 2-5
Important	Median rating 4-5	Median rank > 0
Ambivalent	Median rating 3	NA
Not Important	Median rating 1-2	Median rank 0

Table 2 Classification of questionnaire responses based on the interquartile range and median rating and ranking score.

3. *Questionnaire 2.* 22 of the initial definition statements and five of the initial research questions met the criteria for being included in the second questionnaire round. In addition, three further definition statements and one further research question were suggested by participants in the first questionnaire round and were included. At this stage of the process, each definition was given a thematic code, meaning that in addition to re-rating and re-ranking the remaining definition phrases and research questions, as above, the participants were also asked to rate each of 11 definition themes. The same exclusion criteria as in the first questionnaire round were applied to determine which definition phrases, themes, and research questions were carried over to the final round.

4. *Questionnaire 3*. In the final round, I compiled the remaining definition phrases into a tentative 'definition' of transformation, which the participants rated as before. Seven of the definition themes were carried over to this final round of the process and two additional themes were added for the final rating. Feedback from the participants during the previous rounds of the process indicated some confusion about the ranking of the research questions. For this reason, I re-phrased the remaining six research questions based on my interpretation of them, so that participants were able to judge my interpretation of their ideas.

4.2.2 The Sensitizing Concept and Question

The modified Delphi process generated the following definition of transformation:

> *Transformation is a change in how visitors see the world, the result of a visceral emotional engagement with the content of Invisible Worlds which sparks interest, curiosity and inspiration. It is this culmination of understanding and emotion that creates a 'penny dropping' or 'lightbulb' moment. While the size of the change is not important, it is a positive change with regards to their attitude towards and relationship with the environment, wanting to learn more and feeling empowered to make change. Transformation in Invisible Worlds is unique to each visitor, meeting them at their level, even if they are disengaged. It is a moment which can be built upon as they go throughout their lives.*

The definition was unanimously given a four out of five rating by participants, representing a high level of consensus (Median 4, interquartile range 0). The rating of the individual themes suggested agreement around the importance of engagement, perspective change and emotion, while there was some contention around understanding, personal connection and the direction of change. The participants were ambivalent about the importance of empowerment and diversity. While the definition and themes are not interpreted in detail here, the themes added to the sensitizing concepts going into the visitor research. In Section 9.2, following the main empirical sections of the thesis, we return to the definition to interpret it in light of the findings.

The Delphi process also ranked the remaining research questions, with the highest ranked being unanimously chosen by participants:

> What aspects of the *Invisible Worlds* exhibition design create transformation and in what ways can this be promoted or increased?

This research question contributed to those introduced in Section 2.4 and became the focus of a subsequent phase of visitor research.

4.3 Phase 2: Exploring and Generating Concepts

Following generation of the sensitising concepts and question, Phase 2 was designed to develop initial concepts and understanding of the design process of *Invisible Worlds*. This phase combined a more detailed analysis of the Delphi process discussion with focused participant observation and interviews to not just ask the *what* of *Invisible Worlds*, but the *how* and the *why*.

4.3.1 Focused Participant Observation

Observation offered my first foray into the working life of *Invisible Worlds*. Observing the work of the *Invisible Worlds* team provided useful insight into their practice and maintains the focus on *Invisible Worlds* as a process. After an initial negotiation, it was agreed that I would be able to attend and observe project meetings and take field notes in the style of focused ethnography (Knoblauch, 2005). While sometimes seen as 'quick and dirty' (Wall, 2015), a focused approach provides rich, quality data with an emphasis on intensity (Knoblauch, 2005; Pink and Morgan, 2013) through short and episodic fieldwork.

The fieldnotes, while intensely focused on the practices of *Invisible Worlds* meetings, were descriptive and open-ended, recording anything that seemed relevant at the time in as much detail as possible. The intention was to move towards more selective observation as concepts were developed (Higginbottom, Pillay and Boadu, 2013), however in practice it was only possible to observe a limited number of meetings (four team meetings and one narrative development meeting). The fieldnotes formed an important contribution to the Phase 2 generation of concepts, which was built upon by a more targeted theoretical sampling approach in Phase 3. For example, documents initially collected to provide context to the observational aspects of the research instead constituted a much more in-depth document analysis (Section 4.4.2).

The relatively small number of meetings observed raises important questions about the negotiation of access in action research and organisational research more widely. The *Invisible Worlds* team worked flexibly and adaptably, so it was not unusual to find that meetings were re-scheduled or cancelled without notice. This agile approach however stood in stark contrast to the requirements of research, which treats access as an operational requirement negotiated and specified in advance (Alcadipani and Hodgson, 2009). As Alcadipani and Hodgson assert, this view of access overstates the degree of control the researcher has over the field. For example, the words, 'don't write that down' were not atypical when discussions skirted around organisational weaknesses or interpersonal conflicts. In this way,

access and consent were a minute-by-minute negotiation, which could be readily withdrawn at any moment, with participants shaping access according to their own agendas (Alcadipani and Hodgson, 2009). Whilst disrupted access was a source of personal frustration (Mazzetti, 2016), it is highlighted here to explicate that while the observation provided initial analytical insights, it presented a partial and selective account of *Invisible Worlds*.

Interestingly, many topics which were taboo in the heat of a meeting returned unprompted in the working group meeting discussions (Phase 3) albeit in a more neutral form. This difference in disclosure may reflect the time-sensitive nature of these high-stakes issues. While the project is underway, controversial issues may represent threats to the continuation of the project, which must be managed and contained, to keeps things going. In a neutral space, after the exhibition had launched it was possible to discuss these issues more freely because less was at stake.

4.3.2 Interviewing: Repertory Grid and Opportunistic Telephone Interviews

Initial observations were useful to begin to understand the working practices of the *Invisible Worlds* team, however they offered little direct insight into how the team conceptualised the experience of visitors. The conversations in meetings centered around creating the exhibition for its own sake, rather than being framed in terms of expected visitor experience. Individual interviews were therefore used to supplement the observations and understand how the team thought the exhibition might work. In the first instance, the repertory grid technique (Fransella, Bell and Bannister, 2004) was selected as a structured interviewing technique which can give interviewees a deeper insight into their own thinking by making their tacit beliefs explicit (Gribbin et al., 2016; Jankowicz, 2001), provoking reflection on practice whilst eliciting tacit ‘theories-in-use’ (Argyris and Schön, 1974) The aim with these interviews was to strike a balance between encouraging personal reflection and quickly generating a large degree of insight into the interviewee’s conception of *Invisible Worlds.*

Repertory grid is a structured interviewing method with origins in personal construct psychology (Kelly, 1963), in many ways a pre-cursor to social constructivism,

compatible with the early stages of constructivist grounded theory (Hadley, 2019). In this interactive method, the structure of the interview and topic of discussion is controlled by the interviewer, but within this framework the interviewee is free to construct the data themselves. The interviewees were first asked to list elements of *Invisible Worlds* that visitors would encounter. They were then presented with these 'elements' three at a time and asked which two are most similar, which one is different, and how (Jankowicz, 2004). This process elicits bipolar constructs, which were then further explored through a process of 'laddering' to generate further super- or sub-ordinate constructs. The interview concludes with the interviewee rating each element on each construct. In this study, following a pilot of the method, rather than asking participants to rate the elements on a five- or more-point scale they were asked to choose whether the element fitted more at one pole of a construct, the other, somewhere in the middle, or neither. Because the grids were to feed into the ongoing qualitative analysis, a fine quantitative distinction between elements and constructs was not necessary, and simplifying the rating process expedited the interviews.

The product of the interview, rather than a transcript, is a table of constructs and ratings. While sacrificing much in terms of depth and fine detail, the repertory grids provide insight into how members of the *Invisible Worlds* team conceptualise visitors' experiences. As Hadley (2019) suggests, the elements and constructs developed in the interviews can be seen as *in vivo* open codes, generated by the participants themselves, which can be subject to further inquiry in later stages of the research process. Additionally, an 'eyeball analysis' of the whole grid, looking for associations between elements and constructs, is itself amenable to open coding. However, a challenge I encountered with this approach is that the constructs generated during a repertory grid interview tended to be descriptive rather than analytical, focused on properties rather than process. The repertory grids did not represent the labile and strategic constructions of *Invisible Worlds,* which were readily apparent from the other data generation efforts. This discrepancy created a problem in analysing the repertory grid interviews and delayed the analysis. To resolve this issue, and continue the analysis, I decided to not interpret the repertory grids as definitive, but

as a snapshot in time, co-created between the participants and myself. By seeing the repertory grid in this way, I was able to integrate these open codes into the ongoing analysis of other data sources as properties and dimensions of other more dynamic categories.

In addition to the planned repertory grid interviews, I also conducted two opportunistic telephone interviews with key participants, one with both the exhibition's Curator and Researcher, and one with the Director of Interpretation. The unstructured interviews took an informal and conversational style (Charmaz, 2014), focusing around the participants' roles and involvement in *Invisible Worlds*, the development process, and future plans. However, I had not originally intended on doing such interviews, because I wanted to take a more structured approach, as described above. Telephone interviews were nevertheless suggested by the participants as an alternative means of feeding in to the project with which they were otherwise too busy to engage. While I was cautious that the unsystematic approach of these interviews would undermine the action research process, I also recognised that the interviews may be some of the only opportunities I had to engage deeply with these relatively time-poor participants. While not systematic in approach, the interviews did provide useful insight towards the start of the project to develop codes, which later proved to be central to the analysis through more judicious theoretical sampling.

4.3.3 Analysis: Open Coding and Sorting

I started analysis with line-by-line coding of the Delphi process discussion (Section 4.2.1) transcript in NVivo, keeping as much as possible to active language (using gerunds where possible and the language of participants, known as *in vivo* codes). The ease of doing this process using software quickly generated hundreds of codes which risked losing focus of the bigger picture of meaning in the data (Allan, 2003). Many of the initial codes were descriptive rather than analytic and lacked conceptual power (Holton, 2007) to explain what was going on beyond their micro-level context. To resolve this issue, I roughly sorted the line-by-line codes by comparing them with one-another and the data. Now I was familiar with the data, I was able to drastically

reduce the number of open codes by returning to the data and coding meaningful chunks of data, focusing on key points (Glaser, 1992) informed by the initial coding and sorting. This process still generated over 200 open codes, which I then conceptually sorted and subsumed into 21 tentative focused codes. Conceptual diagramming (Corbin and Strauss, 2015) was vital in this sorting process to visually 'try out' different groupings of open codes, constantly going back to the data and comparing between codes to decide on a reasonable or useful grouping (Figure 4).

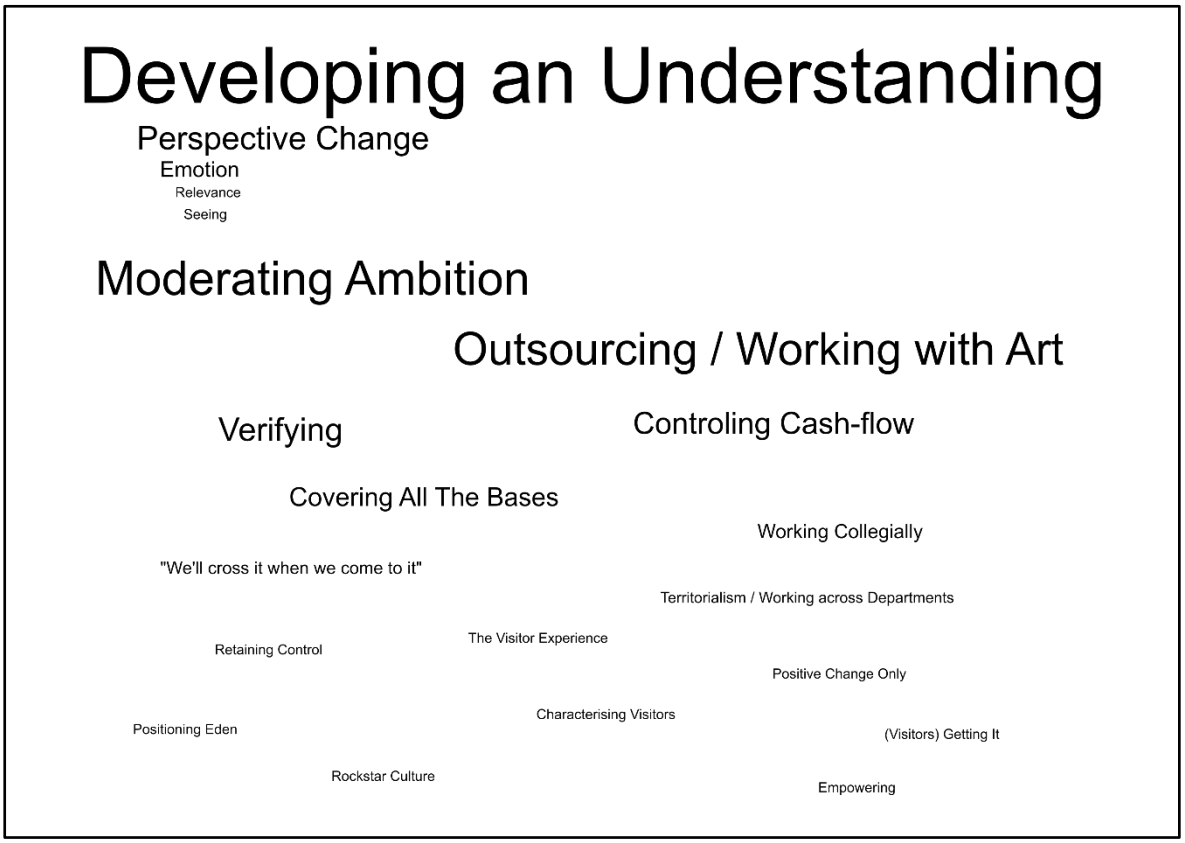


Figure 4 An initial conceptual diagram showing the codes, with proximity and size representing association and analytical priority, respectively.

The initial coding process indicated that DEVELOPING AN UNDERSTANDING may be an important part of the *Invisible Worlds* process. This code subsumed a large number of open codes, which related to how the *Invisible Worlds* team conceptualised how the exhibition would work with visitors. I identified PERSPECTIVE CHANGE, EMOTION, RELEVANCE, and SEEING as potential properties of this tentative category. SEEING seemed to be particularly pertinent to *Invisible Worlds*, due to the intended aim of the exhibition to make the invisible visible. Figure 5 shows an early memo extract for the

code DEVELOPING AN UNDERSTANDING, which links the idea of understanding with SEEING, and identifies possible different interpretations of the concept of seeing as understanding: seeing the invisible, cognitive and emotional understandings, changing the way you see the world, and seeing the world how I see it. At this point, memoing was short and impressionistic, filled with more questions than answers.

The initial analysis was followed by a similar open coding of the rest of the observation and opportunistic interview data. Although keen to advance the analysis to a more abstract and conceptual level and progress to focused coding, I found that the analysis stalled at this stage. Firstly, I was still finding many new things in each data generation effort. Secondly, in contrast to Charmaz's suggestion that focused coding allows the researcher to move through analysing large amounts of data quickly (Charmaz, 2014), my early efforts to progress to focused coding proved to be

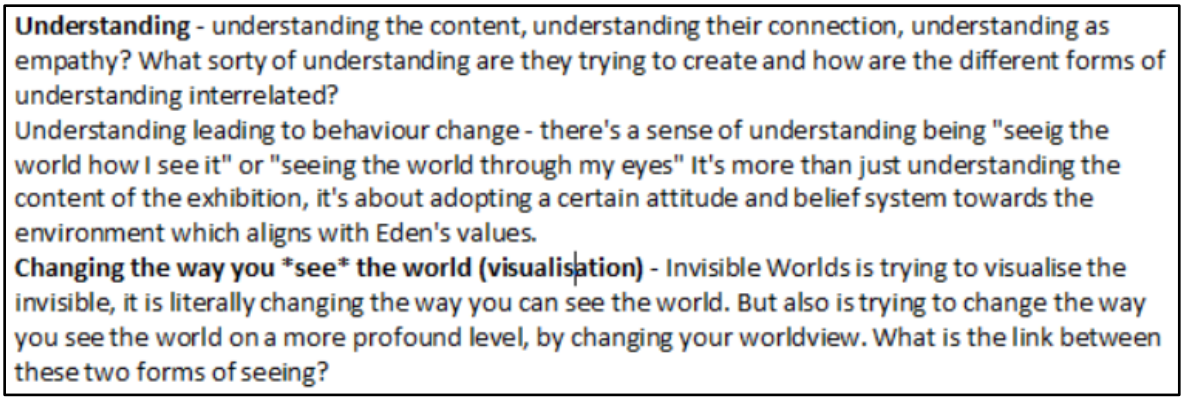

Understanding - understanding the content, understanding their connection, understanding as empathy? What sorty of understanding are they trying to create and how are the different forms of understanding interrelated?
Understanding leading to behaviour change - there's a sense of understanding being "seeig the world how I see it" or "seeing the world through my eyes" It's more than just understanding the content of the exhibition, it's about adopting a certain attitude and belief system towards the environment which aligns with Eden's values.
Changing the way you *see* the world (visualisation) - Invisible Worlds is trying to visualise the invisible, it is literally changing the way you can see the world. But also is trying to change the way you see the world on a more profound level, by changing your worldview. What is the link between these two forms of seeing?

Figure 1 Memo extract for the code DEVELOPING AN UNDERSTANDING, written on 25th January 2018.

laborious and tricky. Finally, as a novice researcher I did not yet have the confidence to make the abductive leap (Charmaz, 2014) required to raise my tentative focused codes to categories to further the analysis. These issues suggested that the tentative categories did not yet adequately capture what was going on in the data. An inspection of the codes showed that they were at different levels of conceptual abstraction and were not yet sufficiently conceptually developed to be coherent or substantive.

I continued coding, diagramming, sorting and re-sorting codes in an open manner, subsuming several smaller, descriptive codes under more conceptually abstract process codes. For example, through this process DEVELOPING AN UNDERSTANDING gained even further priority in the analysis, fully subsuming PERSPECTIVE CHANGE, EMOTION, RELEVANCE and SEEING. I began to consider the potential of raising DEVELOPING AN UNDERSTANDING to the level of a core, or at least significant category, which is fleshed out in a memo extract shown in Figure 6. MODERATING AMBITION also presented itself as an important category which had been apparent in the Delphi process discussion, but which was further elaborated upon in the opportunistic interviews and observation. Interestingly, although I did not recognise the significance of these two codes at this early stage in the analysis, they form the basis of the two core processes outlined in the final version of the analysis. Several other codes at this point lingered without a home. DIVERSITY and COVERING ALL THE BASES, for example, are separated out as potential strategies or sub-codes not yet subsumed under a category. FRAMING THE NARRATIVE is introduced as a new code, which highlights the importance of the exhibition's narrative in the production process and the considerable resource which had been dedicated to developing that narrative.

I've made quite a large group which at the moment I'm calling "Developing an Understanding" or maybe "Developing Mutual Understanding". This includes both understanding of the scientific content knowledge of IW, as well as an understanding in the sense of seeing the world the way that we see the world - a shared vision of environmental sustainability. Part of building this understanding is through visitors "seeing" differently. Again the duality is replicated, in that seeing means both having the invisible made visible, but also a perspective change which changes the way you see the world. This is achieved by scene setting, using hooks, relevance and storytelling. There are interesting parallels between this and "getting it" - in that it's not just visitors, but also collaborators/artists who must have this mutual understanding. However I am cautious about using "mutual", because it seems that actually the understanding is normative - seeing things how WE see them, rather than generating a genuine and reciprocal mutual understanding.

Figure 2 Memo extract for the code developing an understanding, written on 29th January 2018.

Despite making significant analytic gains, the tentative focused codes still seemed disjointed and I could not yet see theoretical connections between them. While emphasising process by keeping coding to gerunds (Charmaz, 2014), I felt that some of the codes were 'forced' (Glaser, 1992), rather than representing well-defined and

identifiable processes in the data. However, as time was moving on it became necessary to put interpretive doubt to one side and artificially advance my analysis to move forward to Phase 3. In this case, therefore, the timing of the project in many ways forced an 'abductive leap' which necessitated both taking my initial interpretations of the data seriously, whilst at the same time stepping back from my interpretations to allow for the consideration of alternatives (Charmaz, 2014). Taking my interpretation seriously means editing and 'solidifying' the tentative focused codes into a more definite list of codes to take forward to the next stage of data generation and analysis. Stepping back means giving each focused code equal footing in the analysis, removing gerunds from the codes that I felt were 'forced', and re-framing and re-wording the codes into a more neutral form to remove some of my pre-conceptions, which were not fully borne out by the data (Figure 7).

In this revised scheme, BUDGET appears as a new focused code, which replaces CONTROLLING CASH-FLOW. This reflects that the budget was a large factor in the production process, which occupied much of the team's efforts, but neither control

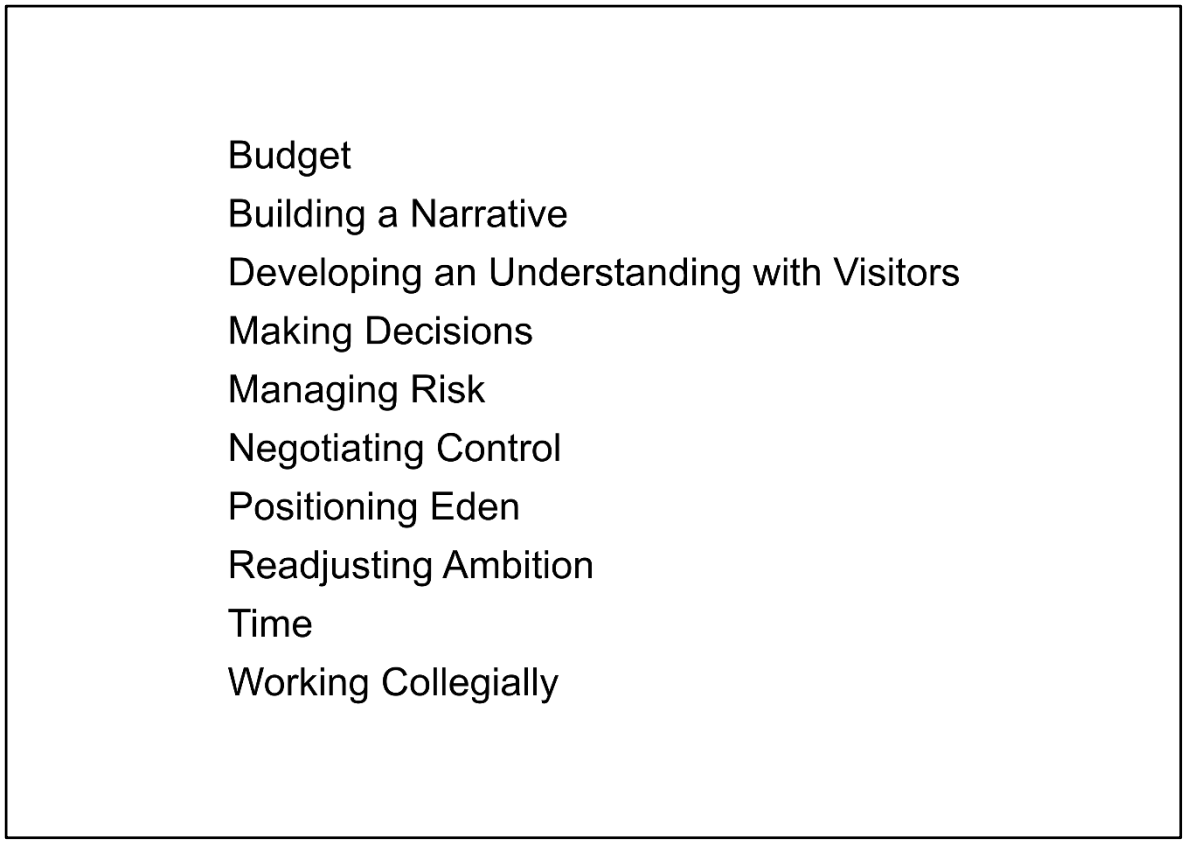


Figure 3 The revised coding scheme, giving each focused code equal priority in the analysis.

nor cash-flow adequately captured all of what was going on. I took a step back from my conceptual commitment by including it instead as a generic property rather than a process in its own right. BUILDING A NARRATIVE subsumes several of the tentative focused codes centered around the exhibition's narrative, another major focus of the team's work. The subsumed codes included CHARACTERISING VISITORS, RETAINING NARRATIVE CONTROL, FRAMING THE NARRATIVE and VERIFYING. DEVELOPING AN UNDERSTANDING WITH VISITORS remained as an important category, however its priority over the other codes was removed and it was re-worded to specify that it is visitors who should understand. CHARACTERISING VISITORS is also subsumed under this category, offering a potential link between the production of the exhibition narrative and visitors' assumed understanding. 'WE'LL CROSS IT WHEN WE COME TO IT' was re-worded as MAKING DECISIONS to capture decision-making more generally, rather than just focusing on delaying decisions. It also partly subsumes WORKING COLLEGIALLY, as one form of consensus-based decision-making. However, I also decided to keep WORKING COLLEGIALLY as a separate code, to reflect working practices more generally within the team and across the Eden Project. MANAGING RISK is a new focused code, which came about from re-visiting one of the opportunistic interviews. The interviewees framed the *Invisible Worlds* project as highly risky, so I felt that the concept of risk merited further analysis. NEGOTIATING CONTROL separates out the control dimensions of CONTROLLING CASH-FLOW and RETAINING NARRATIVE CONTROL to consider control as an important factor in the *Invisible Worlds* project. POSITIONING EDEN retains its status as a focused code. READJUSTING AMBITION re-words MODERATING AMBITION to reflect the words of the participants. TIME came across as an important dimension of the production of *Invisible Worlds* in one of the opportunistic interviews. The participants described how time slowed and quickened, bunched up or spread out at different stages of the project. This code was included to capture temporal aspects of the process. WORKING COLLEGIALLY remained as a focused code and subsumed WORKING ACROSS DEPARTMENTS OR TERRITORIALISM, to reflect working practices within the *Invisible Worlds* team and across the Eden Project more generally. The initial code, which referred to inter-departmental territorialism was framed rather negatively. I decided to step back from this negative framing to focus on working practices more generally.

4.4 Phase 3: Fostering Reflection and Saturating the Concepts

Phase 3 marks the transition from exhibition planning to exhibition launch and a return to the field to generate more data and test tentative concepts through theoretical sampling. The main strategy to further the tentative analysis was focus-group-style working group meetings, supported by a theoretical sample of documents collected throughout the process. The meetings had an additional role of fostering reflection and provoking action, whilst further deepening my and the team's own understanding of their practice.

4.4.1 Working Group Meetings

The main strategy to keep momentum behind the action research whilst generating more focused data was to organise working group meetings to allow the team to reflect and comment on the analysis thus far. The design of the meetings was informed by both grounded theory 'theoretical group interviews' (Morse, 2007) and action research 'participant focus groups' (Genat, 2009), as well as focus group methodology more widely. Morse (2007) suggests using small group interviews as a form of theoretical sampling to expand emergent ideas. In these interviews, the participants are presented with the findings so far and asked to discuss and provide further examples to fill in 'thin' areas of the developing theory, so that the researcher can begin to saturate concepts. Morse cites an additional benefit of this method as providing insight into the potential applications of the theory from the participants' perspective. This method is distinctive from similar methods used as a 'member check', in that the group interviews are targeted to extend the developing analysis, rather than to confirm or validate a finished product. Genat (2009) takes a similar approach to theory generation, albeit within a participatory action research framework, using a 'participant focus group' to develop new shared meanings between the participants and researcher. This approach privileges the group's perspective, as its members are those with most stake in how the phenomenon under study is understood, but also advocates referring back to primary data and contrasting the group's views with those of other stakeholders to ensure credible representation. Touted benefits of this approach are the production of local

knowledge around a phenomenon, and the implicit action derived from this new knowledge. A focus on 'key issues' allows the group to get at aspects of a particular problem or phenomenon, which form the core of broader issues. The meetings in this study were designed around these principles, to allow saturation of the developing theory, whilst developing local knowledge and allowing participants to direct the analysis. Six meetings were planned over the course of six months to be progressive, moving sequentially from open-ended reflection on the production of *Invisible Worlds* to the development of action points, practices or policy based on those reflections. Unfortunately, as described in Section 4.1.2, the meetings ceased after three sessions due to a change in group membership, which limited the method's capacity to create local knowledge or action.

Notwithstanding the premature ending of the meetings, they provided a rich source of data in a relatively short amount of time (Morgan, 2001; Wilkinson, 1998) Focus group discussions are more naturalistic than other methods, which allows for a structured discussion, whilst the conversational style facilitates personal disclosure (Guest et al., 2017; Wilkinson, 1998). As the participants conversed with each other, they expanded on and validated their shared experience and expertise (Jung and Ro, 2019), developing categories or concepts from the analysis that were important to them (Cooper, Diamond and High, 1993). Because the participants had worked closely with one another, the interactions in the meetings could be seen as a re-creation of the research context (Morgan, 1997), which provided a thorough exploration of how the *Invisible Worlds* team gave meaning to and organised the exhibition production, allowing for an understanding of process to develop (Carey and Asbury, 2016).

Meeting 1, Discussion 1. The categories from the organisational analysis (Figure 7) were laid out on a table and the participants chose one each to discuss. Going around the table one-by-one, the discussion started with the participant reading out the category they had chosen and explaining why they had chosen it, before opening the discussion up to the group. Once the discussion of the category began to wane, the discussion moved on to the next participant and their category, until each participant had talked about their chosen category.

Meeting 1, Discussion 2. In a second exercise, visitor interview transcripts were laid out on the table, chosen to illustrate a range of tentative categories from the visitor analysis. The participants read through the transcripts and freely commented and discussed their first impressions.

Meeting 2, Discussion 1. The second meeting was designed to explore the categories of TIME and EMOTION in more depth. In one of the opportunistic interviews, the Curator had discussed how delaying decision making had slowed the project down, and how the project became 'bunched up' towards the end. While we had discussed the category MANAGING TIME in the previous working group meeting, the verb 'managing' did not adequately capture what had been described. By explicitly focusing on TIME as a property, I hoped to understand how time seemed to slow or speed up, spread out or bunch up during the project, and was particularly interested in how this related to stress and other emotions throughout the course of the exhibition's development. The participants wrote down key events in the production of *Invisible Worlds* on a timeline, and then choose one each to discuss. To provide further stimulus during the discussion, the participants were encouraged to refer to a list of emotions, which they had previously expressed about *Invisible Worlds*, as well as the developing grounded theory categories which they were familiar with from the previous meeting. The discussion was structured as in Meeting 1, with each participant saying which event they had chosen and why before opening up the discussion to the group. Interestingly, all participants chose to discuss the exhibition launch event, as an emotional crescendo of the exhibition's development, when time (or lack of it) was most acutely felt.

Meeting 2, Discussion 2. The second part of Meeting 2 consisted of a discussion of the tentative categories from the analysis of visitor interviews. As in Meeting 1, Discussion 1, the participants chose one each to discuss. Going around the table one-by-one, the discussion started with the participant reading out the category they had chosen and explaining why they had chosen it, before opening the discussion up to the group.

Meeting 3, Discussion 1. At the beginning of Meeting 3, I was surprised by the drastic change in membership of the group. The majority of the previous attendees were not

there, and while I welcomed the new attendees' participation, none of the newcomers had been involved in the production of *Invisible Worlds*, and I doubted how useful or insightful the discussion might be. However, I took the meeting as an opportunity to disseminate my analysis more widely and perhaps gain alternative outside perspectives on my analysis so far. At the beginning of the first discussion, I re-introduced the action research project, as well as my analysis so far and the new conceptual framework, WORKING TO WORK: BALANCING, MANAGING AND GETTING BY. Being unable to continue specific discussion points from previous meetings, I facilitated an open discussion of the analysis, encouraging participants' thoughts and comments. The discussion subsequently led to the participants' reflections on successful and unsuccessful aspects of the exhibition.

Meeting 3, Discussion 2. As in Discussion 1, I gave a detailed overview of the visitor research method and analysis so far, before inviting general questions and comments. The participants were encouraged to draw on their own experience to add to my analysis.

4.4.2 Document Analysis

Due to the limited and focused observational aspect of the research, it was important to generate supplementary data, which could provide background and contextual information to the analysis. To this end members of the critical reference group were encouraged to submit project documents throughout the process, which they felt would be relevant to my understanding to the development of *Invisible Worlds*. While this sample, being submitted by members of the team themselves, is inherently biased, fragmentary and uneven (Bowen, 2009), it maintains the commitment of both action research and constructivist grounded theory to privilege the realities of the participants in the analysis. The corpus consisted of 107 documents, including meeting minutes, narrative overviews of the exhibition and artists' briefings. Some of the documents were provided in several versions, which allowed changes over time to be tracked.

Documents have been an important feature of grounded theory since its conception (Glaser and Strauss, 1967), as well as useful in action research. While I originally

intended the documents to be a useful record to 'fill in' gaps in my understanding of what happened in producing *Invisible Worlds* when I was away from the Eden Project, it soon became apparent that, rather than being an objective record, the documents surrounding the *Invisible Worlds* project were *doing* things (Charmaz, 2014; Prior, 2008). Participants referred to documents in meetings and discussions and talked about using documents to negotiate with artists and designers. 'Master files' became authoritative sources of scientific fact against which all other exhibition content must be checked. 'Storylines' acted as brokers between the 'logical' process of building the exhibition narrative and the 'creative' exhibit design process. Instead of being objective sources of information in themselves, the documents represented what the *Invisible Worlds* team saw as objective (Charmaz, 2014). This is not to say that what is recorded in the documents is falsified in any way, but rather that what is recorded can be seen as 'social facts', which create and privilege a particular version of reality (Atkinson and Coffey, 2011). On the occasions where I was able to observe meetings, comparing my field notes with the meeting minutes proved particularly analytically useful in this regard. In addition, the selection of documents by the participants themselves adds an additional dimension in terms of the kind of documented reality of *Invisible Worlds* they want to portray to me as a researcher. In this situation it becomes important to ask what is and is not included, how the documented reality is framed and enforced (Charmaz, 2014).

In practice, although document collection started from the beginning of the action research, I initially found it difficult to include the documents in my analysis. Highly structured and formulaic documents seemed to add little grist to my Phase 2 interpretations using other data sources, as outlined above. However, as the analysis progressed, the documents became of increasing interest and became a major feature of the Phase 3 analysis. As open coding progressed to focused and then to theoretical coding, I began to theoretically sample from the corpus of documents to saturate my analysis. The documents provided a different lens on the categories I was developing, allowing me to identify and refine their conceptual boundaries (Bowen, 2009). In particular, the large cache of meeting minutes stood in as a remnant of the production process, constructing a rational cause-and-effect

sequence of decisions and events (Atkinson and Coffey, 2011; Bowen, 2009). The temporal aspect of these documents proved to be particularly useful in understanding how organisational processes waxed, waned, and transformed over time.

4.4.3 Analysis: Progressing to Focused and Theoretical Coding

Data from the working group meetings proved to be analytically fruitful by drawing theoretical links between categories. The fluency with which the team recognised and discussed the categories added credibility to my interpretation of events. From

PROCESS CODES
- Managing Risk
- Managing Time
- Negotiating Control
- Readjusting Ambition

PURPOSE CODES
- Building a Narrative
- Developing an Understanding with Visitors
- Positioning Eden

STRATEGY CODES
- Characterising Visitors
- Covering all the Bases
- Making Decisions
- Outsourcing or Working with Art
- The Visitor Experience
- Verifying
- Working Across Departments
- Working Collegially

VARIABLE CODES
- Ambition
- Budget
- Control
- Risk
- Time
- Trust

UNSORTED
- Controling Cash-flow
- Framing the Narrative
- Retaining Narrative Control
- Rockstar Culture

Figure 4 Codes sorted into different conceptual 'types'.

the first meeting, the importance of emotions, particularly stress and relief, became apparent in a way which was not clear in the preliminary data from Phases 1 or 2. These disclosures prompted going back over the data, particularly looking for emotionally charged content. Another addition was an emphasis on the influence of senior management in *Invisible Worlds*, an aspect that had been largely omitted from previous data. I developed a new category, BECOMING A TRUSTED TEAM, which accounted for the work involved in developing the trust of senior management.

The discussions from Meeting 1 prompted a conceptual re-sorting of the codes and categories developed thus far to capture the variable levels of abstraction and theoretical links between codes (Figure 8). This work suggested several 'types' of codes. PROCESS CODES attempted to capture the core of what is going on. The continual balance of AMBITION, RISK, and CONTROL, in a situation with limited TIME showed *how* the exhibition came to be. PURPOSE CODES represented the work which relates to *why* the exhibition exists – DEVELOPING AN UNDERSTANDING WITH VISITORS whilst simultaneously POSITIONING EDEN to legitimise its status as an authority on the environment. STRATEGY CODES consisted of processes and ways of working which support both the PROCESS CODES and PURPOSE CODES. The VARIABLE CODES began to separate out possible properties and dimensions of the *Invisible Worlds* process.

Going into Meeting 2, I framed the discussion to explore how TIME and EMOTIONS worked in the *Invisible Worlds* process. Interestingly, all of the participants chose the exhibition launch party as the event they wished to discuss, as it represented an emotional crescendo in the exhibition's production, focused around the selection of the guest list. This discussion led to re-considering the position that POSITIONING *Invisible Worlds* and the Eden Project took in the analysis and the role this played in legitimating *Invisible Worlds* as a potential authority on science, art, or the environment. From the discussion, it was easy, and shocking, to infer that the main concern of the participants was making sure the right people were invited to the party. My strong emotions surrounding this question acted as an 'analytic prod' (Copp, 2008), prompting me to explore my assumptions about the research. Through this reflection and by returning to the data, I came to understand that much of the work being done around *Invisible Worlds*, which seemingly had little to do with the content or form of the exhibition, was nevertheless a vital part of the process as a whole. The team were often occupied with what I called ENABLING WORK, essential work which has to be done just to keep the project going. With this new line of enquiry, I was able to re-focus my analysis and assimilate several key categories into one framework, WORKING TO WORK: BALANCING, MANAGING AND GETTING BY (Figure 9).

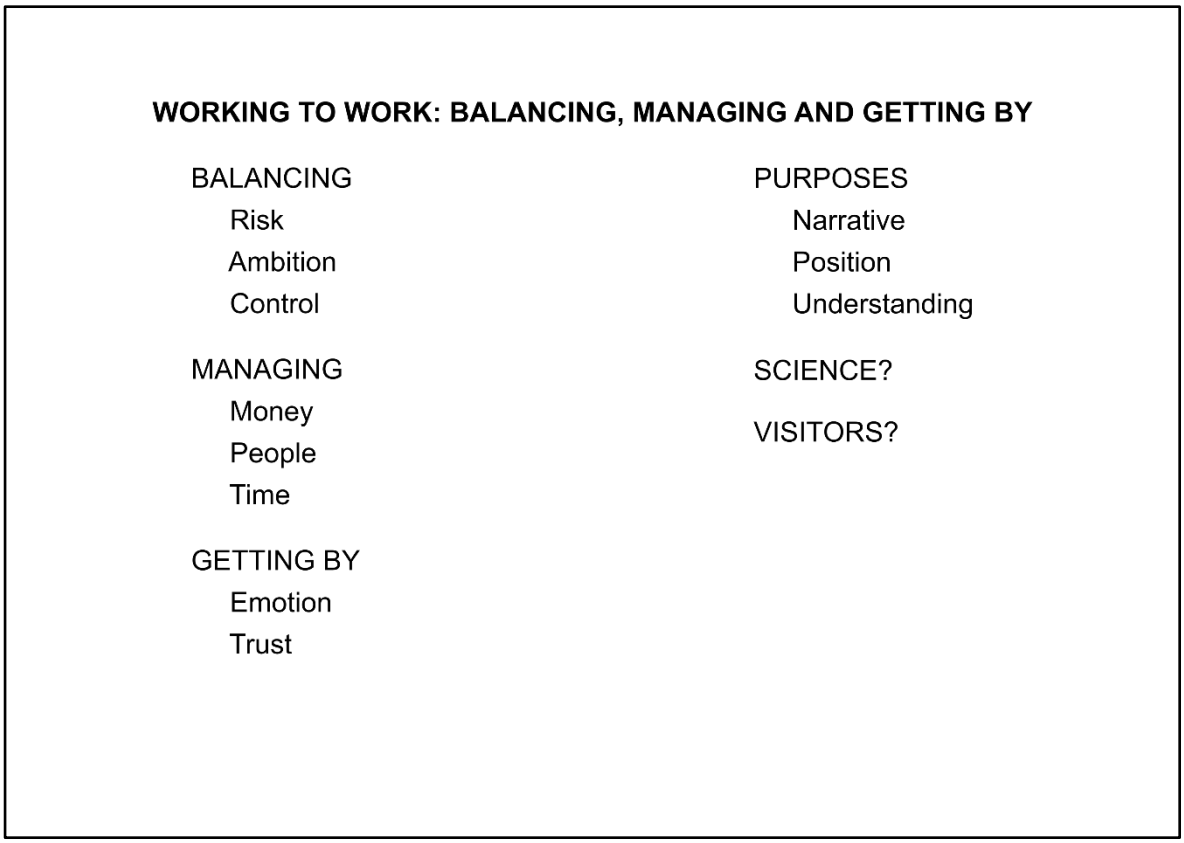


Figure 5 A revised analytic framework following Meeting 2.

This is the conceptualisation of producing *Invisible Worlds* is what I brought into Meeting 3 for discussion with the team.

In an attempt to further the analysis, I began to theoretically re-sample the original data. At the same time, whilst I had done so in a piecemeal way throughout the analysis, I began to theoretically sample more concertedly from the corpus of documents. Meeting minutes enabled honing-in on the temporal aspects of each category, while narrative documents re-instated the importance of the construction of the exhibition's narrative. Ultimately, I decided to take a step back from my commitment to WORKING TO WORK as a core category, instead returning to the idea of ENABLING WORK. As discussed above, this type of work was clearly a major focus of the *Invisible Worlds* team, but it seemed to bear little relation to the aims of the exhibition itself. To that end, I created the category PURPOSIVE WORK, to encapsulate the work, which directly contributes to those aims (either explicit or implicit). While appreciating that what might be considered as either ENABLING or PURPOSIVE may be somewhat arbitrary, the distinction provides a useful analytic lens through which to

interpret the work of *Invisible Worlds* for two reasons. Firstly, it makes it possible to ask concrete 'what if?' questions of the data, such as, 'what if POSITIONING *INVISIBLE WORLDS*/EDEN AS A CENTRE FOR EXCELLENCE were PURPOSIVE rather than ENABLING?' By so doing, it enables analysis of the interaction between potentially competing explicit and implicit aims of the exhibition. Secondly, by examining the interface between enabling work and purposive work, it becomes possible to untangle the influence of more distal actions on *Invisible Worlds*.

4.5 Chapter Summary

This chapter has given an overview of the methods used to generate and analyse data about the organisation of *Invisible Worlds*, informed by constructivist grounded theory and action research. It detailed how the critical reference group of key participants were included in the research. Beginning with a Delphi process to define the sensitising concept of transformation, as well as a sensitising question, the study then moved to understand *Invisible Worlds* as a process. Using methods to provoke reflection, such as repertory grid interviews and working group meetings, and supplemented by documents, constructivist grounded theory analysis was used to explain the how and why of the exhibition's production. The methods of analysis were discussed in detail, showing how key analytic decisions were made and the principles of grounded theory were applied, such as simultaneous data collection and analysis, considering alternative interpretations, constant comparison, open, focused, and theoretical coding. The next chapter gives the results of this organisational analysis.

5 Organisational Results: Exhibition Production as a Process of Negotiated Ambition

> *'[When the Eden Project was founded,] we didn't employ people who were skilled in that job, we just employed people who wanted to go on this adventure. And it's trying to do that now in an organisation which is however many years old it is, which is becoming more formulaic… We've got to hang on to that independence and that rigging and that organic evolutionary process.' (Director of Interpretation)*

In this chapter, I outline how the 'adventure', the 'organic' practices the Director described were maintained by the enabling and legitimating work of NEGOTIATING AMBITION (Figure 10*)*, a form of institutional work which supported and enabled the production of *Invisible Worlds*. Talking about how things had changed since the Eden Project was founded, the Director of Interpretation described a struggle to keep old, more creative ways of working in the face of increasing professionalisation and institutionalisation.

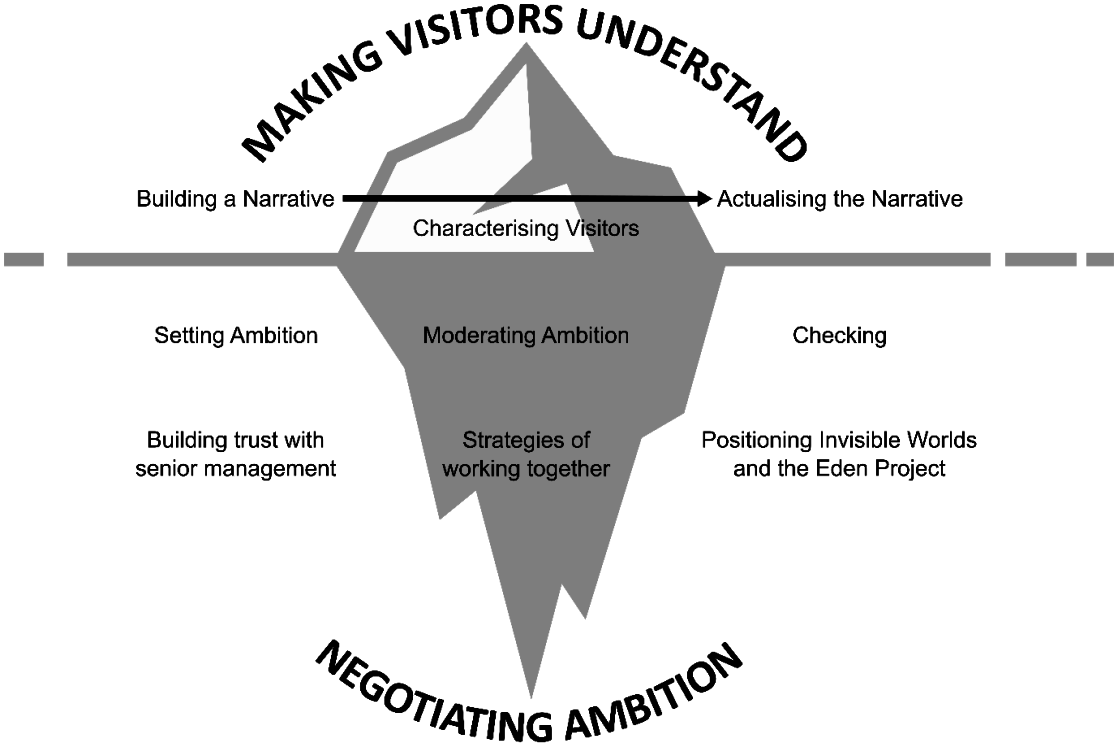


Figure 6 The explicit process of producing Invisible Worlds, MAKING VISITORS UNDERSTAND, was enabled and influenced by the tacit, enabling processes of NEGOTIATING AMBITION

Nevertheless, when asking the team in interviews or discussion meetings about creating *Invisible Worlds*, the processes of BUILDING A NARRATIVE and ACTUALISING THE NARRATIVE are what they most often described. On the surface, this explicit, linear process of creating the exhibition worked towards the aim of MAKING VISITORS UNDERSTAND (Figure 10). Taken as a whole, MAKING VISITORS UNDERSTAND therefore represented the 'textbook' process of how the exhibition was created, moving from one step to the next until the exhibition was completed. However, the production of the physical *Invisible Worlds* exhibition was only one aspect of the work conducted by the exhibition team.

I argue, drawing on illustrative quotes from the *Invisible Worlds* team, as well as excerpts from documents and field notes, that the linear process of producing the exhibition was enabled by the complex and mutually-constitutive enabling processes of NEGOTIATING AMBITION. As such, the processes which are outlined below are necessarily fuzzy, and co-dependent, in line with sensitising concepts as imagined by Blumer (1954). Rather than being presented in a reductive propositional form, relationships between the processes are explained and illustrated throughout the text in a 'discussional' form more suited to grounded theory (Glaser and Strauss, 1967). First, I outline the dimensions of the exhibition production process, before outlining its constituent sub-processes which themselves make up MAKING VISITORS UNDERSTAND and NEGOTIATING AMBITION. The chapter concludes with an extended comparison between two exhibits, which draws together and illustrates the previously outlined concepts.

5.1 Dimensions of analysis

Key to interpreting the processes of producing *Invisible Worlds* has been the articulation, through grounded theory analysis, of the dimensions of these processes. Dimensions represent the range or extent of aspects of a phenomenon (Dey, 1999). In the case of *Invisible Worlds*, the dimensions are the conditions, resources, constraining factors, and other aspects of the *Invisible Worlds* production process which the team sought to manage. In general, the exhibition was framed as having a high level of both ambition and risk, whilst being produced within a resource limited

and highly emotionally charged context. All the while, the trust of senior management was vital for getting the work done. An understanding and articulation of these dimensions explains why and how *Invisible Worlds* was created as it was and how a process of NEGOTIATING AMBITION influenced the work of creating *Invisible Worlds*. To reduce repetition, I describe the dimensions briefly here to highlight some of the common threads running throughout the remainder of the chapter.

5.1.1 Ambition

Invisible Worlds was consistently framed as 'hugely ambitious' (Coordinator). By ambitious, the team meant that the exhibition stretched the expertise and capacity of both the *Invisible Worlds* team and the Eden Project more broadly, as well as covering a 'hard topic' (Curator). However, rather than taking this claim at face value, I consider why *Invisible Worlds* was framed in this way, and how this framing influenced the exhibition itself. By planning such an ambitious project with limited resources, the team were acutely aware that they were taking a significant risk in terms of falling short. As the curator of the exhibition put it,

> *There's always a nerve-wracking moment when you know that you're going to have less resources and less time maybe than you thought you would have, to deliver something extremely ambitious. It becomes quite risky, quite stressful. (Curator)*

Planning such an ambitious project necessitated that the team take further strategic risks, such as commissioning artists and designers to create exhibits, instead of using their in-house design team. These risks, as described below, resulted in the team developing strategies to maintain control over the exhibition whilst working to maintain the ambitious framing. While pervading every aspect of the exhibition's production, this dimension is most clearly articulated through the process NEGOTIATING AMBITION, through which I argue that the ambitious framing of the exhibition and maintenance of this frame had significant consequences for the content and form of *Invisible Worlds*.

5.1.2 Trust

The dimension of trust refers to the trust held by senior leadership (senior management and board members) in the *Invisible Worlds* team. The team regarded senior leadership to hold sway over the exhibition, having a key role in defining its ambition and passing judgement on its success.

> *Because on the opening night, if they'd all turned around and gone [it's not good enough]… and they do… then you know you haven't met their ambition. (Team Member)*

Much rested on the approval of these senior leaders who might arrive at the opening party of the exhibition and declaring it a failure. The necessity of building trust was one of the factors, which motivated the framing of the exhibition as highly ambitious, but where trust was low it had tangible consequences, ultimately necessitating NEGOTIATING AMBITION. In general, however, the high level of trust the team felt was placed in them allowed work to continue autonomously without overbearing interference in comparison to other projects. This higher level of autonomy meant that production ran smoothly without too much delay.

> *We were allowed to get on with it... If you can take a project clean... separate it from the senior management team and they trust that team to get on with it, that's when it happens. (Director of Interpretation)*

However, this high level of trust was not consistent throughout the entirety of the exhibition's production, which led to delays, limited choices, and high levels of stress. Trust (and the autonomy this granted) was therefore a crucial condition influencing the ability for the team to get on with the work of creating *Invisible Worlds*.

5.1.3 Resource

> *We had to do what we had the resource to do, which is three things, time, money and people (Director of Interpretation)*

Time, money, and people constituted the resource of the project, all of which were in short supply. This resource-limited context gave rise to the process of NEGOTIATING AMBITION, firstly by motivating the setting of an ambitious frame, and then through its

moderation when the team realised they would be unable to fulfil everything they had promised.

Firstly, the available budget had a major influence over the team throughout production. A shortfall in funding resulted in the team 'having to squeeze budget' (Curator), ultimately leading to the ambition of the exhibition being moderated. The team diverted considerable attention towards filling the funding gap in an attempt to maintain the initial ambition. One successful bid was made to the Arts Council, which, whilst partially filling a shortfall, also allowed the Eden Project to maintain its frame of ambition by positioning itself externally as a centre for excellence in the Arts. However, maintaining ambition was not always possible. Talking about the reduced scope of the exhibition's play area, a member of the team noted, 'We knew what the budget would supply, and that's what we did.'

The subjective experience of time throughout the production of *Invisible Worlds* was also important. The *Invisible Worlds* Curator reflected on the impact of a lack of certainty in the early stages of production:

> *There should have been more planning and [we should have] allowed more time. A lot of the bulk of the work then gets, you know, bunched in the last few months. And then you, you know, it all becomes a bit of a race against time. (Curator)*

Lack of decision-making early in the exhibition's planning led to its production being 'bunched' at the end of the process, so that 'it all did happen in the last year' (Curator). While the team attempted to manage time, the inevitable progression of time through fixed points, ultimately up to the exhibition launch date, constrained options available to the team. A lack of time generally, and a lengthy planning process, described as 'bandying about', eventually led to a great degree of stress and frustration for team-members who felt decisiveness was lacking.

Finally, the people who comprised the team were also themselves a vital resource who worked to keep exhibition production going. The team itself was porous, with members dropping in and out as necessary. This allowed the team to work flexibly around other projects, and in general 'collegial' working and consensual decision-making distributed the work according to availability. However, problems occurred

when this way of working broke down, placing burden on core members of the team as responsibilities mounted. In some cases, there was a sense of the exhibition taking over entirely, '*Invisible Worlds* doesn't fit into my work, my life tries to fit into *Invisible Worlds*.' (Director of Interpretation). At certain points, team-members felt overwhelmed when normal collegial support was withdrawn as other priorities arose, 'I had ten days of coming in, until I sort of melted down on that day eight and stopped coming in. So, it was, it was quite intense period.' (Team Member).

Overall, the exhibition was produced in a resource-limited context, which constrained possibilities and necessitated strategic decisions in terms of maintaining commitment to an ambitious framing whilst working within practical limitations. As ambition was negotiated, this limiting context contributed to an emphasis on positioning *Invisible Worlds* and the Eden Project within a social arena, as discussed in Section 5.3.6, to maintain the ambitious frame.

5.1.4 Emotion

The emotional dimension of creating *Invisible Worlds* was something 'we never talk about' (Team Member) and was therefore not apparent until the working group meetings after the exhibition had opened, when the team began to discuss and reflect on their work more candidly. It became apparent that the production of the exhibition had a powerfully emotional component, described by several members of the team as being 'stressful', 'terrifying', and 'nerve-wracking', which had thus far remained under the surface. These heightened emotions were in part due to NEGOTIATING AMBITION, because 'You squeeze the team when you negotiate ambition.' (Team Member). These feelings had tangible consequences, as the Head of Policy described, after disagreeing with the commissioning panel on the choice of Centrepiece artwork:

> *From that moment 'till the moment we launched I had this terrible feeling that it was, everybody was going to go, 'Pff.' But it had quite big knock-on effects because it meant that I… I simply couldn't do [the publicity], because I could not stand up and say we've got this wonderful thing. (Head of Policy)*

The feeling of stress became part of the framing of the exhibition as ambitious as key members described being pushed to an emotional limit, with the success of the exhibition being predicated by a feeling of relief. However, where stress remained unresolved it led to frustration. Paying attention to emotions therefore helps to understand the strategies used and decisions made by the team to ensure success of the exhibition.

5.2 Making Visitors Understand

MAKING VISITORS UNDERSTAND is the process by which the *Invisible Worlds* team worked towards the explicit aims of the exhibition, taking *Invisible Worlds* from idea to physical reality. This process relied heavily on the development of a 'narrative' which structured and delimited the scientific content to be included. Rather than relying on any one conventional definition of the rather contested term narrative, I refer to narrative here as what the *Invisible Worlds* team themselves refer to as 'narrative'. This includes how and why scientific content was included or excluded, as well as decisions around how this information should be divided and sequenced.

The verb *to make*, in MAKING VISITORS UNDERSTAND is used in its sense of compulsion, that on visiting the exhibition, by its very nature, visitors are obliged to understand. This meaning encapsulates the idea of what at the Eden Project is called 'education by stealth' – that visitors will 'get it' without even realising it. I refer to the unexamined assumptions and tacit constructions upon which the team relied to justify, compose, and bring the exhibition into being. In the following sections in this chapter, I show that these often strategically applied constructions shaped the *Invisible Worlds* exhibition, influenced not just by labile characterisations of visitors, but also on the enabling processes of NEGOTIATING AMBITION. *Understand* is meant to convey visitors perceiving intended meaning, but also developing sympathetic awareness. By MAKING VISITORS UNDERSTAND, I do not just mean that visitors ought to comprehend the content, but refer to the sense that by visiting the exhibition, visitors will see the world the way that *we* (the team) see the world. This sense of understanding encapsulates assumptions around affective engagement with visitors through creative, interactive, and artistic media, as well as the fundamental premise of

visualisation of the exhibition – that through science enabling us to visualise the invisible, visitors will understand and appreciate their connection to the natural world.

The 'narrative' which *Invisible Worlds* presents is that science helps us to visualise invisible aspects of the natural world such as vast earth systems, microscopic life-forms, and geological processes which stretch far back in time. By visualising these usually invisible aspects of the natural world, we should better understand our connection to and relationship with nature, as the exhibition narrative overview illustrated:

> *Exploring the world beyond our senses: too small, too vast, too slow, too fast, too far away in space or time... An engaging introduction to the invisible and the interconnectedness of life and the Earth's environments at all scales – revealing how life is shaped by, and shapes, invisible systems. (Invisible Worlds Narrative Overview Document)*

The narrative is therefore divided by physical and temporal scales as indicated by the titles of the 'gateway' exhibits, 'Small', 'Vast', and 'Past'. The narrative is further divided by elemental 'environments' (Air, Soil, Rock, Water). Each of these divisions includes further sections devoted to framing the content as individually relevant (e.g. 'what's in it for you'), extreme or life-changing, and presenting solvable challenges.

Rather than taking this narrative structure as given, and by taking the approach of seeing its construction as a process, it is possible to understand the tacit assumptions that governed its production. In the following sections, I do not provide an analysis of the narrative of *Invisible Worlds per se*, but rather of the processes and influences which indicate how and why this narrative came to be. I show how the processes of creating and actualising the narrative were significantly shaped by the contexts within which the work happened. It is for this reason that I have not called this process simply 'creating the exhibition', but rather MAKING VISITORS UNDERSTAND.

5.2.1 Building a Narrative

BUILDING A NARRATIVE is the process the *Invisible Worlds* team used to create the exhibition's overarching message. Spurred by the opportunity proffered by a funding call from Wellcome, the initial idea for *Invisible Worlds* promised to resolve several

ongoing issues at the Eden Project. Talking about the exhibition's origins, the Director of Interpretation framed *Invisible Worlds* as not only vital but also directly fundable: 'It felt like a massive missing piece of the jigsaw, and Wellcome felt like an opportunity to fill that gap.' (Director of Interpretation)

Talking further, she positioned *Invisible Worlds* as a continuation of what the Eden Project was doing already. More practically, the exhibition narrative provided an opportunity to correct perceived past failures, as well as re-invigorate a part of the Eden Project which, now at over ten years old, was looking tired.

These initial ideas were made concrete in the funding bid to Wellcome but when it was funded the team had a sense that what they had committed to would be difficult to achieve. Initial excitement was tinged with doubt. The ambition to cover so many domains of scientific knowledge (the initial funding bid mentions topics as diverse as microbiology and artificial intelligence) necessitated a difficult process of reducing, structuring, and delimiting the narrative content. When discussing the origins of the exhibition's narrative, the following exchange between the Director of Interpretation and Curator gave some insight into this process:

> ***Director of Interpretation:*** *…when we first got the grant, I remember the Head of Policy and I were like, 'Yes!', on the way back on the train. And it was like, 'Oh my god!', you know, 'How are we going to...?'. So, we had several, the Head of Policy and I had several meetings with a big bit of paper to start with and we had everything on there. And it was, my favourite thing is post-rationalising and compartmentalising and putting things into...*
>
> ***Curator:*** *But I think that process, because...*
>
> ***Director of Interpretation:*** *That story, that was...*
>
> ***Curator:*** *...it was so vast...*
>
> ***Director of Interpretation:*** *That was, yeah, difficult.*
>
> ***Curator:*** *...and so, difficult or challenging and really, you know, and to choose the things that are going to be relevant, interesting, appealing. Sometimes you can't always fit everything. So that process took quite a bit of time.*

The Curator made sense of the problem of BUILDING A NARRATIVE outlined by the Director of Interpretation by framing the process as difficult and time-consuming. Due to the ambition of the project it was necessary to take time to carefully define the narrative, especially around content, which was deemed as being 'risky' (Curator), and open to mis-interpretation by visitors. The taking of time reinforced the difficulty of the task at hand and sustained the ambitious framing of the project, despite delayed decision-making, referred to as having 'bandied about' (Team Member), having the practical consequence of reducing the available time for ACTUALISING THE NARRATIVE.

The narrative was given facticity by the creation of documents. Each narrative element was written into individual authoritative and lengthy 'master files', which demonstrated the depth and breadth of background research the team had conducted. These files were verified by scientists, lending the narrative legitimacy through expert authentication. These documents controlled the production of the exhibition by providing a reference-point against which all other work could be checked. Once verified and cross-referenced, the documents became a record of scientific fact against which all other content, including artworks, exhibits, interpretation etc. would be checked. As such, the creation of these documents acted as a strategy to retain narrative control over the exhibition.

To summarise, the *Invisible Worlds* team generated the exhibition narrative through a coming together of several factors. The narrative was given life by situating it within the Eden Project's existing narrative, going through a laborious process of extensive research, narrowing down, and structuring, which re-inforced the ambitious framing of the exhibition. It was then rendered into 'fact' through verification with expert scientists and 'cemented' in documents. In the following sections, I describe how the narrative was mapped onto the physical space to create the exhibition, before explaining the characterisation of visitors, which motivated choices throughout these processes.

5.2.2 Actualising the Narrative

Once the painstaking work of BUILDING A NARRATIVE had been done, work moved towards creating 'the physical manifestation of all of this work, all of this research' (Researcher). ACTUALISING THE NARRATIVE meant mapping the narrative onto a 'visitor journey' (Director of Interpretation) and making the exhibition a physical reality. The visitor journey was imagined as non-linear, with key messages distributed across all exhibits so that 'if you just go to one you'd get the story' (Director of Interpretation) although ultimately each topic was allocated to an exhibit in a one-to-one fashion. This is the part of the process where reality set in, and what was realistically possible within the limited available resources became apparent. Certain narrative elements, such as content on climate change, water, and food were cut or postponed to reduce repetition and adjust to available resource.

The process involved working with an external commissioning agency, establishing an arts commissioning panel, and commissioning and collaborating with external artists and designers. This approach was more formalised than Eden's normal mode of working, where they would typically use their internal design team, and an informal process of commissioning artists, as described by the Director of Interpretation:

> *We didn't use a panel we just worked together as a group of people quite randomly and said, 'Oh, you know… we know this person and that person. Let's get them in.' (Director of Interpretation)*

It was implied that outsourcing some of the exhibition content allowed the Eden Project to introduce digital interpretation, which 'we don't have a big track record of doing… [it's] the first time we're doing large digital interactive stuff' (Curator). However, when I asked the Director of Interpretation about this she asserted, 'We outsourced because we wanted to explore working with new people rather than because we didn't have the resource to do it in-house' (Director of Interpretation). Having previously 'always veered away from digital' (Researcher), these differing views paint an arguably contradictory picture of *Invisible Worlds*. Logically, in a resource limited context, it would have made sense to make use of an already employed in-house team rather than paying the relatively higher cost associated with outsourcing. I do not make any claim, however, that one or another view is the 'real'

or ‘truthful’ one. Instead, this situation illustrates the two-sided nature of many aspects of *Invisible Worlds* – at the same time both pragmatic or practical, while working to maintain an ambitious framing. This situation shows how it is not just decision-making which is important, but also the framing of decision-making; as part of NEGOTIATING AMBITION, which is explained in detail later in this chapter, pragmatic decisions were re-framed as ambitious.

Like BUILDING A NARRATIVE, ACTUALISING THE NARRATIVE also involved the extensive use of documents. While the previously created ‘master files’ remained a record of science ‘fact’, ‘story line’ documents were created for the team to negotiate the content of the exhibits with the commissioned designers and artists. As the Researcher described,

> *The story line very much works with the artists and the designers... Quite often there will be certain parts of the narrative that they will pick out… When their proposals come back, we can see how closely that matches with the narrative and how closely it fits with the original funding… We then start to formulate a storyline which is where you use the master file as your background and you really start to pull out the sections that they want to focus on and break it down, make it a lot simpler for them to kind of really take it on board so that they can inform their design. (Researcher)*

In this process, a narrower range of content was selected from the much broader pool of research generated by the team, in negotiation with the artists or designers, and complex scientific content was simplified to become ‘understandable’. Some decisions worked around the individual interests of the commissioned designers, while others were more practical in terms of ‘what’s feasible… how much space there is for content’ (Researcher), but always in reference back to the master files and funding bid.

In summary, ACTUALISING THE NARRATIVE was the point when reality set in and feasibility began to reduce the narrative content, which could be presented in the exhibition. A more formalised process of commissioning artists and designers allowed the Eden Project to extend its expertise to include digital interpretation, whilst also allowing them to work with new people. Documents still provided a level of narrative control over the exhibition, whilst ‘story line’ documents acted as boundary

objects between the team and commissioned artists and designers to negotiate content. Through this process, the narrative scope of the exhibition became narrowed and content simplified.

5.2.3 Characterising Visitors

Throughout production, the exhibition content was influenced by an imagination of what visitors to the Eden Project are like. The visitor imagined was a rhetorical construction or 'implicated actor' (Clarke, Friese and Washburn, 2017) used to strengthen and justify the position and framing of *Invisible Worlds*, as well as approaches to production and design. The team drew on personal experience, 'formative evaluation', or academic literature to support these labile and sometimes contradictory constructions of visitors.

While these characterisations of visitors were not discrete or mutually exclusive, for the sake of interpretation it is possible to break them down into five general forms:

The visitor as diverse – This construction was used to show the uniqueness of each visitor, 'There's seven and a half billion people around or something like that. There's seven and a half billion different sorts of visitors. Everybody starts at a different entry point' (Director of Interpretation), and thus the enormity of the challenge in engaging them, as well as the broad general appeal and popularity of the Eden Project was established. However, in being diverse, visitors characterise in this way, for example in the Wellcome funding bid, could also be 'hard-to-reach' or 'low science capital', emphasising a deficiency, which motivated and justified Eden's intervention. The diversity of visitors motivated using a broad variety of approaches in the exhibition itself, as evidenced by the following exchange:

> ***Director of Interpretation:*** *what we chose, each piece, well, the pieces in, in their entirety appealed to a broad demographic. So, there was something for kids, there was something for women, there was something for people who wanted close observation, there was something mechanical, there was... So, there was a mixture.*
>
> ***Team Member:*** *And there was humour, beauty...*
>
> ***Director of Interpretation:*** *Yeah.*

Team Member: *...horror.*

The ‘broad demographic’ which the team were attempting to appeal to thus shaped the variety of affordances available in the exhibition (e.g. close observation, mechanical interaction), as well as the intended affective experience (humour, beauty, horror), described by one member of the team as a ‘beautiful compromise’ (Team Member).

The diversity of visitors was also used to justify the content level of the exhibition, particularly in response to criticism that the level was too low:

> …our audience is very broad-based, you know. And from some of the feedback we've got from [evaluation] and that. People don't, some people don't even know what a *microbe* is. Well, you have to address that. You can't just assume prior knowledge, because you’ve got a very, very mixed demographic of people. So, you can't pitch above their heads at all. (Director of Interpretation)

The visitor as diverse therefore did not just justify intervention, but also reinforced a cognitively deficient construction of the visitor.

It was often informally mentioned that Eden visitors were more similar to zoo visitors than visitors to a typical botanic garden or museum. This characterization implied that visitors to Eden, on average, had a lower socio-economic status and therefore were more diverse. During the production of *Invisible Worlds*, this motivated participation in the Association of Leading Visitor Attractions (ALVA) survey, which compared visitor demographics as more or less similar to attraction types, such as zoos, museums, etc. This study became a strong source of evidence to support the construction of the visitor as diverse, at the same time positioning the Eden Project as unique, not like other similar attractions.

Overall, the diverse visitor was a flexible construction, which linked demographic characteristics to the material and content design of the exhibition. This construction could be applied in different contexts to meet a number of aims, characterizing visitors as either unique, special, or needy and deserving. At the same time, the visitor as diverse served to support positioning the Eden Project as unique amongst similar attractions.

The visitor as stupid and disinterested – In the face of criticism or as a result of moderated ambition, the diverse visitor could be transformed into the stupid and disinterested visitor. While not always wholly derogatory, this cognitively deficient construction legitimated structuring and simplifying the exhibition's scientific content, as described by the Curator, 'a lot of the concepts are very hard to comprehend. So, I think... that it, it had to be narrowed and structured.' As can be seen from this quote, the stupid and disinterested visitor was justified by positioning the content of the exhibition as challenging, liable to misinterpretation, and sometimes even 'risky'.

The stupid and disinterested visitor served two seemingly contradictory functions. First, as already described, this construction legitimated simplifying and structuring the content of the exhibition. At an extreme, this meant a dramatic simplification of content to an almost superficial level,

> *We have people come to Eden, there's some people who come to Eden, they went, 'Oh, huh, that's funny there's an exhibit called tea and they've got a leaf on it. Like a leaf just sitting on there', and… they realise that they were drinking a plant. (Director of Interpretation)*

As well as the structuring of the exhibition into small chunks to accommodate visitors' apparent short attention span, 'if they're anything like the squirrels that we are, 'Oh, brilliant, yeah, great', and then they go away and go, 'Oh, a pasty, great', you know' (Policy Development Manager).

Second, at the same time, the stupid and disinterested visitor reinforced the framing of the content and form of the exhibition as challenging,

> *Either people are happy to come in and have an Instagram picture or their fashion blog, or they want to know what it is. There haven't been people saying, 'Err, it's a sort or representation of some stuff'. I can, you know, people, our visitors have struggled with an art piece, I think, for the sake of art, in a science museum. (Team Member)*

As can be seen from the words of the Team Member, the stupid and disinterested visitor was not used exclusively. She contrasted the visitor who wants a photo for Instagram with the visitor who wants to 'know what it is'. Nevertheless, both visitors are constructed as deficient. While the fashion blogger *is* perhaps stupid and

disinterested, satisfied with a superficial experience, the visitor who wants to 'know what it is' struggles to conceptualise the abstract and indeterminate nature of art. In both cases, art is positioned as being challenging for 'our visitors'.

Despite their differences, both functions of the stupid and disinterested visitor worked towards demonstrating the ambition of *Invisible Worlds*. On the one hand, this construction supported the ambitious frame by showing how the content of the exhibition was so ambitious, that it required extensive simplification to make it understandable to a cognitively deficient audience. The ambition in this sense is in the challenge to the team to make complex topics understandable. On the other hand, the stupid and disinterested visitor is also to be challenged by the exhibition, for example through the use of art. The ambition becomes creating an exhibition which challenges visitors' understandings.

The visitor as regulatable – The regulatable visitor is one who is subject to 'flow' and a homogeneous 'visitor journey'. In contrast to the diverse visitor, this conception of the visitor reduces individuals to units of regulation, most often in bulk. The regulatable visitor is passive, while the exhibition is given agency to absorb, manipulate and control visitors, both physically and emotionally.

One form in which the regulatable visitor appears empirically is through expressions of visitor numbers, for example in the Wellcome funding bid, which hopes to attract more visitors to Eden as a whole, as well as to the Core building where the *Invisible Worlds* exhibition is situated. This construction of the visitor also appears in informally discussed design guidelines for the Eden Project, where each individual attraction must be able to 'absorb' one hundred visitors at a time to promote smooth visitor movement throughout the site.

The regulatable visitor is portrayed as emotionally and attitudinally labile. In an initial discussion early in the research process, members of the team, when describing Eden's approach, expressed that they did not want to 'overwhelm' or 'depress' their visitors, which might 'send them back down the snakes and ladders', instead preferring to inspire 'awe and wonder'. This conception assumes that the visitor is

responsive and able to be changed by the visit, and that emotional regulation of visitors is both possible and desirable.

The visitor as consumer – At an extreme, the regulatable visitor becomes the consumer visitor. The visitor as a consumer seeks satiation – this is the visitor who is subject to visit exit surveys which ask how satisfied they are with their visit. Similarly to the regulatable visitor, the consumer visitor becomes a statistic among thousands or millions; their value is calculated in numbers and income generation.

In *Invisible Worlds*, the consumer visitor was expressed primarily in two ways. Within the Core building itself, *Invisible Worlds* provided a consumer experience through a themed café whose menu was meant to illustrate the key concepts of the exhibition, for example by focusing on fermented foods. Similarly, in the gift shop, a line of *Invisible Worlds*-related products was developed, again extending the visitor experience of *Invisible Worlds* into that of a consumer experience.

As I explore further in the discussion (Chapter 0), I do not highlight this construction of the visitor with any particular normative or moral implication (I am not claiming that providing a consumer experience in itself is bad). Nevertheless, it is important to note that such experiences conflate consumer experience with meaningful experience and learning, or at least represent a blending of these experiences. Through the visitor as consumer, the visit it imagined as consumption, something which visitors desire, which effects satiation through volume of consumption, of content, foodstuffs, or giftshop items.

The visitor as us – Finally, the *Invisible Worlds* exhibition team also constructed visitors as like themselves, most often used to justify particular approaches used or other constructions of visitors. For example, as previously quoted, the Policy Development Manager describes visitors as ‘squirrels like we are’ to, through self-deprecation, legitimate the rather derogatory depiction of visitors as having a short attention span.

In general, the visitor as us validated drawing on personal experience to justify choices made in the exhibition design. The most extensive example of this involved

conducting considerable formative evaluation of *Invisible Worlds* content using Eden Project staff as the sample. On one of the Eden Projects' yearly closure days, called the 'Gathering', when all-staff meetings are held, activities relating to *Invisible Worlds* were set up in the Core building for staff members to preview and provide comment on. Interestingly in this example, the visitor as 'us' did not mean 'us, the exhibition team', but 'us, the Eden Project', under the premise that the various other constructions of the visitor (e.g. diversity) are embodied by the Eden Project staff as a whole.

Overall, there was no one coherent imagination of the visitor, public, or target audience. Even if only implicitly, constructions of visitors were used strategically, deployed in different circumstances to support different ends. Constructions of visitors are on one hand necessary to further the production of the exhibition, providing an imagination of who the exhibition might be for and how it might be materially realised. On the other hand, characterising visitors also had strategic, tacit uses. This underscores the dual nature of many of the processes of design – both explicit and necessary, whilst also tacit and strategic. With this dual nature, I argue that characterising visitors acted as the main bridge between the explicit process of MAKING VISITORS UNDERSTAND and the tacit process of NEGOTIATING AMBITION. As ambition was negotiated throughout the project, different constructions of visitors were leveraged, which had material impacts on the exhibition itself.

5.3 Negotiating Ambition

NEGOTIATING AMBITION captures the work which both enabled and constrained the process of creating *Invisible Worlds*. This work created and sustained the necessary conditions within the Eden Project, such as funding and the trust of senior management, so that the team could do the work of MAKING VISITORS UNDERSTAND. I argue that the framing of *Invisible Worlds* as ambitious was a necessary part of this process, and that the work of negotiating ambition was therefore centred around creating and maintaining this frame. As such, negotiating ambition includes the more-or-less tacit aims of *Invisible Worlds* of legitimation and institutional maintenance. However, in the face of limited resources, the commitment to such an ambitious

framing also constrained the exhibition's production as the team worked to maintain it.

5.3.1 Setting Ambition

> *[The ambition] was set out in that, the original bid. Like I think that… it was set out that we were going to do something very ambitious at that point. (Curator)*

As the *Invisible Worlds* Curator explained, the high ambitions of the exhibition were made concrete in the initial funding bid to Wellcome. Framing the exhibition in this way was arguably necessary to secure the funding, but the influence of the Eden Project's senior management and board also played a significant role.

> *Some of the senior team want it to attract visitors. Some of it want to reposition us in terms of our scientific integrity. And some people just want it to take us into a new sphere, to set us apart from other people and do things differently… Each director in the senior management team has a different [thing that] they want from it. (Director of Interpretation)*

The highly ambitious framing therefore also played to the individual proclivities of members of senior leadership. The team felt that articulating a clear ambition was vital in ensuring the trust of senior management and the autonomy that this granted:

> ***Curator:*** *It had a very clear set, like, by a certain point we had a clear amount of how much [money] we had and how much we had to deliver it for, and it had a clear deadline, which not all projects have.*
>
> ***Team Member:*** *And ambitions.*
>
> ***Curator:*** *And it had quite a clear ambition. So, I think those things are always quite helpful.*

As such, setting ambition at the outset was one of the main ways in which the *Invisible Worlds* project was able to be initiated. Setting ambition involved clarifying and setting out what *Invisible Worlds* was to deliver and aimed to achieve, and making a commitment to meet that ambition.

Important to note, however, is that ambition is not the same as the aims and objectives of the project. Ambition in itself, while clarified to an extent, maintained an ambiguous quality. In the quote above, while some ambitions were fairly straight

forward (more visitors), most were qualities open to interpretation (scientific integrity, entering a new sphere), representing what could be called the ‘spirit’ rather than the letter of the project, and thus enabling them to be negotiated throughout the exhibition’s development.

5.3.2 Moderating Ambition

Moderating ambition happened when reality started to set in and the team realised they had less time and money than they would have liked,

> *As budget has been tightened and tightened and tightened, the original intention and the ambition and the realities of delivering that on site, there's always a kind of readjusting that happens from a budget point of view. It's like, oh yeah, we said we'd do all this but oh, yeah, that isn't going to happen. (Curator)*

The constrained resources of the project led to a process of reassessing the ambition of the project, including, as mentioned by the curator, in light of the material reality of the site. As one member of the team succinctly put it, ‘it's a four million pound project and we delivered it for three.’

Moderating ambition, while necessary, was a highly risky process, as explained in the following exchange,

> ***Curator:*** *What are the effects of readjusting ambition? Risk of not meeting the ambition, the initial ambition. So, I think there's always a nerve-wracking moment when you know that you're going to have less resources and less time maybe than you thought you would have to deliver something extremely ambitious. It becomes quite risky, quite stressful.*
>
> ***Team Member:*** *That's a big point. Stress on the team.*
>
> *[…]*
>
> ***Director of Interpretation:*** *It's a hugely stressful project… I've done lots of projects here and this one was the most stressful one I've ever done.*
>
> ***Curator:*** *And I think, you know, the [ambition], it was readjusted, but you also, there are creative solutions that come out of that. And I think, I'm trying to think of an example.*

> ***Team Member:*** *You're forever doing creative solutions. It's what you do.*
>
> ***Curator:*** *But I think it's from everybody. I think you just have to kind of, we do end up having to think of things in a slightly different way...*

Moderating ambition thus heightened the risk that the ambition of the project might not be met, which became a subject of intense stress for members of the project team. For example, the Director of Interpretation described a 'nerve-wracking' episode when the Eden Project board and trustees started to question whether the exhibition's ambition had been met,

> *I was asked by the directors to share the original pitch that we did to Wellcome with the board and the trustees. And then they got me into a room and they said, 'Why haven't you done the interactive thing of that? And why isn't there a film screen?' And that was to do with... readjusting ambition. So, we had to do what we could afford to do. We had to do what we had the resource to do, which is three things, time, money and people. So, we had to cut our cloth accordingly. (Director of Interpretation)*

As the Director described, the justification for moderating ambition was working within constrained resources. However, moderating ambition was also about, through the other processes of negotiating ambition, as well as by CHARACTERISING VISITORS, working to maintain the framing of the exhibition as ambitious in spite of practical constraints.

5.3.3 Checking

> *But it's just it's just we're kind of there's been a few things recently where it's been like, right yeah we need to go and double check, oh yeah that's fine we're actually doing that. (Curator)*

Checking was the process of going back to the original intention of *Invisible Worlds*, most obviously solidified in the funding bid, and making sure that the team had fulfilled, in both letter and spirit, what they committed to doing. Important to note is that the ambition of *Invisible Worlds* represented the spirit of the project's aims and objectives, subject to negotiation, rather than their objective or literal meaning. However, as will be shown in the following paragraphs, checking is the aspect of negotiating ambition where the line between ambition and objectives became

blurred, which brought ambition further from or closer to either the letter or spirit of the exhibition's intended aims.

The team were acutely aware that not meeting the ambition of *Invisible Worlds* could have serious practical and financial implications, beyond the disappointment of having fallen short, with the Head of Policy describing the 'threat of clawback if we don't do it. They could. I was reading the contract.' By clawback, the Head of Policy is referring to funders requesting a return of funds if the team are unable to sufficiently demonstrate that the ambition of the project has been met. But it was not just funders' requirements which had to be checked against. Senior management were also a vital gauge in determining if the ambition of the project had been met. As previously mentioned, the reaction of senior management at the opening party was hotly anticipated.

The nervous anticipation of the possibility of not having met the ambition fueled the process of checking, which the Reseacher described as,

> *…we're kind of back against what we said we would do and just double checking that we are actually doing it. And you have to refer back to the bid all the time and the original intentions and the original ambitions. So, we're just constantly trying to go back and say, 'OK, yeah, we are actually doing what…' We are doing kinetic with the artworks. So, it's just we're maybe we're not going to be delivering exactly what we said in the bid. (Researcher)*

Despite in this case perhaps not achieving the exact letter of the intention, the Researcher explained how the team were at least doing so in spirit – they were 'doing kinetic', even if not in its originally intended form. By so doing, the ambition of this aspect of the project was able to be maintained. Nevertheless, it was not always possible to maintain the 'spirit' of ambition in this way. The converse example is that of the play area, which drastically reduced in scope throughout the project, eventually leading to one member of the team, as previously quoted, to exclaim, 'We knew what the budget would supply, and that's what we did.' And so, through checking, the ambition of the play area became reduced, closer to the letter of the exhibition's aims. Despite considerably moderating ambition, it became possible to show that the aim of the play area had, nevertheless, been met.

5.3.4 Becoming a Trusted Team

An essential element of negotiating ambition was building trust with senior management. As mentioned in Section 5.1.2, trust was a vital factor in gaining autonomy from the senior management team to work on *Invisible Worlds* relatively independently. BECOMING A TRUSTED TEAM therefore consisted of strategies for making sure trust was high at the outset of the project. The following exchange from the first working group meeting illustrates the three main strategies, which the *Invisible Worlds* team used to build trust:

> ***Team Member:*** *But in terms of other projects, the higher levels were so engaged with it, there was less delay than there has been on a lot of other things. Everyone knew about it. Had a very good project team. People engaged. It did move along. Of course, there's always pinch points, aren't there, on availability, but...*
>
> ***Director of Interpretation:*** *We were allowed to get on with it, which was... So, Invisible Worlds was taken, you know, if you can take a project clean, and take that project, separate it from the senior management team and they trust that team to get on with it, that's when it happens.*
>
> ***Team Member:*** *Yeah, I think, you've...*
>
> ***Director of Interpretation:*** *And they did, didn't they.*
>
> ***Team Member:*** *You've nailed it. I've not seen it that, like that quite as much. And you and [the project manager] bore the brunt of...*
>
> ***Director of Interpretation:*** *But it wasn't...*
>
> ***Team Member:*** *...getting it through the exec processes. Which at other times it's fallen to all sorts of different people and it gets a bit slower.*
>
> ***Director of Interpretation:*** *So, [the Project Manager] drove that through. It also happened with the build of this building and of the rainforest canopy walkway, in that you take it away, because a trusted team is put on it to deliver it and get on with it. Otherwise it gets...*
>
> ***Team Member:*** *I didn't know we were a trusted team.*
>
> ***Director of Interpretation:*** *...completely stuck.*
>
> ***Coordinator:*** *I think, I think we have been. We've been...*

> ***Director of Interpretation:*** *I think we have, yeah.*
>
> ***Team Member:*** *No, we have. I do now realise that, yeah.*
>
> ***Coordinator:*** *They've pulled in the money and, and pretty much let us get on with it within parameters, and that's...*
>
> ***Curator:*** *And I think it had a, had a...*
>
> ***Team Member:*** *I think it's because we pulled in the money.*
>
> ***Curator:*** *It had a very clear set, like, by a certain point we had a clear amount of how much we had and how much we had to deliver it for and it had a clear deadline, which not all projects have.*
>
> ***Team Member:*** *And ambitions.*
>
> ***Curator:*** *And it had quite a clear ambition.*

As can be seen from the above discussion, the team attributed becoming a trusted team to three factors:

Personal advocacy – Unlike previous projects, one person, the project manager, was responsible for liaising with senior management. The team attributed this approach to being able to get *Invisible Worlds* through the senior management approval process more quickly than other projects. The language used, 'drove', suggests a certain level of purpose, focus and determination compared to other projects where it had 'fallen to all sorts of different people', which suggests a previously more unfocused and *ad hoc* way of working with senior management.

Clearly defining ambition – Much effort was spent at the outset of the project on negotiating ambition with senior management, in part through personal advocacy. Clearly defining ambition directly links SETTING AMBITION to BECOMING A TRUSTED TEAM. As seen in the discussion excerpt above, the team associated the clarity of the ambition with having well-defined timeline and budget, which the team worked to 'pull in'. By clearly setting these parameters, as well as demonstrating that they were able to secure the needed funds themselves, the team build trust with senior management that they could pull the project off successfully.

Having the right team – In subsequent discussion, members of the team described the team as 'strong', 'supportive', and 'engaged'. The sense from this discussion was that having the right team meant being pro-active, supporting one another, working

collegially and by consensus. The right team was thus more defined by working practices than the identity of its members.

In summary, becoming a trusted team was the process by which the team worked to maximise the dimension of trust in *Invisible Worlds*. As trust was maximised, the team were granted more autonomy, being allowed to 'get on with it' without interference – a condition to which the team attributed much of their success.

5.3.5 Strategies of Working Together

The *Invisible Worlds* team employed strategies of working together, which allowed them to manage workload and realise the project's ambition. As mentioned in the previous section, the team was described as being 'supportive' and 'engaged'. In general, this description represented a collegial mode of working based on 'a surprising level of consensus' (Team Member). While, as I observed in my meetings and interactions with the team, there was, as might be expected, disagreement and tension, these disagreements do not find their way into the document record of the project. One part of this consensus-building process was in 'narrowing down' the content of the exhibition while building a narrative. This lengthy process, which was described as having 'bandied about', was nevertheless, as the Curator put it,

> *…really important for the exhibition, and I think for the events and everything else, so that there's, everyone knows, kind of, the limits of what the narrative is, and what is in or out of it.*

Part of this narrowing down was the creation and use of Master File documents which, as explained earlier in this chapter, became seen as authoritative records of scientific fact. Beyond being a record of fact, however, their use also had the function of managing disagreement by presenting a united front, which pointed towards a singular course of action. These documents made it possible to resolve disagreement by CHECKING, going back to see what commitments had already been made. As such, working collegially and by consensus did not mean that there was no disagreement at all, but that disagreement was able to be managed, in reference to authoritative documentation, so that it did not impact on the delivery of the project.

Aside from documents, the team also innovated new ways of decision-making and working together through selection panels, for example for the Infinity Blue sculpture at the centre of the exhibition,

> *We worked on the brief with [a commissioning agency] and we also put together a panel of Eden staff, key members of Eden, but also external influences so that was composed of [the director of a high profile art gallery], someone from Wellcome Trust, so actually brought in [a curator at the Wellcome Collection], we had [someone from Cornwall County Council] and we had [the architect of the Core building]. Then Eden staff wise we had [senior staff], myself, and I think oh then we had [a scientific expert]. So that was a panel composed of staff and the art world and scientists. And the idea with that was to commission artwork you really need to have a variety of voices around the table and it needs to be quite a transparent process. And that was quite a different way of commissioning to what we've done before. (Curator)*

As the curator explained, one purpose of creating a commissioning panel was that it collected a variety of authoritative voices together in a transparent process. This transparency of decision-making was seen as important in legitimating important decisions around the exhibition, which, as described later in Section 5.4, in cases where this broke down, caused tensions to rise.

5.3.6 Positioning

Invisible Worlds and the activities associated with it were consistently used to strategically position the Eden Project in relation to the worlds of art, science, and informal science learning. While mostly remaining implict, this aim was explicitly outlined in the initial funding bid, 'To promote Eden's place as a leading practitioner in informal science learning… a scientific hub for the South West… a significant venue for science and the arts.' (Wellcome funding bid). Much of this positioning revolved around framing the Eden Project as 'mavericks' (*Invisible Worlds* Meeting Minutes 08/03/2017) by creating a careful balance of legitimate participation in the art and science worlds, whilst at the same time remaining on the edge of those worlds by distancing themselves from established actors. As one team member illustrated: 'We add a lot more of that emotive side to things… Whereas a traditional garden or a traditional [museum] wouldn't kind of get there…'

This positioning, while partly relying on a 'need to modify language' (Field Notes from Meeting 07/03/2018), was more than just rhetorical, and had tangible implications in terms of the modes of practice used, collaborations nurtured, and resources acquired by the team. For example, it was established early in the process that the team would need to take on a 'more curatorial role' (*Invisible Worlds* Meeting Minutes 08/03/2017), if they were to be taken seriously in the art world. 'There is a bit of disagreement on whether it is a good idea to have an external panel in the decision-making process. The Curator argues that it is valuable to have an outside eye and external influence to place the artwork within the wider world of art (something there has been criticism for not doing in the past).' (Field Notes from Meeting 28/06/2017). Ultimately, the need to position the Eden Project as a centre for excellence in the arts motivated working with a commissioning agency, founding an arts panel, and applying for Arts Council funding.

POSITIONING, however, like CHARACTERISING VISITORS, was labile and strategic. Reacting to comments from Wellcome about the content of the exhibition, the Director of Interpretation remarked,

> *I don't think they were from our world. I think they were from a world that was used to assessing science centres. We are not a, well we are a science centre, but… So, they said 'A lot of the stuff you say you are going to communicate is sub-sixth-form', or words to that effect. And that offended me because our audience is very broad-based, you know. And from some of the feedback we've got from our evaluator's work and that. People don't, some people don't even know what a microbe is. (Director of Interpretation)*

Through her words, the Director of Interpretation re-positions the Eden Project apart from those giving the criticism, and other science centres generally. While the detractors may contend the content of the exhibition is not ambitious enough, by positioning the Eden Project and its audience as separate from other science centres, and by legitimating this claim by referring to 'evaluation', the Director of Interpretation maintains the ambitious framing of *Invisible Worlds* by re-defining ambition as being ambitious for *our* visitors. Positioning therefore had implications for the production of the exhibition. By working to maintain the ambitious frame, a

cognitively deficient characterisation of visitors was created, which, as shown above, influenced the design of the exhibition itself.

5.4 Putting it all together: Comparing Infinity Blue and Vast Invisible

Having outlined each of the processes and sub-processes of producing *Invisible Worlds*, it may be helpful to illustrate these processes and their interactions by way of an extended comparison between the production of two exhibits. The exhibits, described below, were chosen for comparison initially because they became the subject of detailed discussion during the third working group meeting, several months after the exhibition had opened. The impression was given that visitors enjoyed both exhibits to an extent, but did not really 'get' either of them, and that both required modification to interpretation, known as 'snagging', to correct this problem. However, one was nevertheless labelled a great success, and the other a failure. Going back through other data, there had been important differences in their production, and in particular the negotiation of ambition, which contributed to this labeling. Through this comparison, I suggest that while NEGOTIATING AMBITION during production of the 'successful' exhibit, Infinity Blue, allowed the ambition frame to be maintained, the production and negotiation of ambition of the 'unsuccessful' exhibit, Vast Invisible, did not. Through these examples I show how negotiating ambition influenced the production of both exhibits and ultimately whether they were labeled a success or failure.

The first example is the centrepiece artwork of the exhibition '∞ Blue' (Infinity Blue), shown in Figure 11. Infinity Blue is an eight-meter-high ceramic scupture, situated within the main atrium of the Core building, which produces scented smoke rings at periodic intervals. While semi-abstract in form, the sculpture represents the production of oxygen by cyanobacteria, which nearly four billion years ago created the oxygenated atmosphere we breathe today. Second is Vast Invisible, shown in Figure 12, one of the 'Gateway' exhibits introducing the topic of Earth systems in a small exhibition area immediately following the main Core entrance. The exhibit is made up of three screens illustrating the carbon, phorphorous and nitrogen cycles.

As visitors stand in front of the screens, their silhouette is placed on the screen, showing how humanity influences the cycles.

Figure 7 The centrepiece artwork Infinity Blue, as captured by a visitor to Invisible Worlds.

The centrepiece artwork was not mentioned in the initial funding bid, however it was mentioned in meeting minutes from January 2017 (the beginning of the records made available for this research). The origins of the centrepiece idea are therefore somewhat un-documented, although some members of the team suggested that it was based on a request directly from senior leadership. The direction to commission such a large and conspicuous artwork may have come from a desire to position the Eden Project as a credible actor in the art world, and is suggested by the artists' brief specifying the piece should 'drive the PR for the project… contributing to the charity's profile' (Eden *Invisible Worlds* Artist Brief, June 2017). Vast Invisible on the other hand seems to have come from a combination of several aspects mentioned in the initial funding bid, including the 'World Views' section 'Too Vast', meant to give insight about scientific measurement and observation, as well as 'The Cycles', intended to be interactive devices embedded into immersive environments to explore nutrient cycles by physically creating phenomena such as clouds and lightning.

Figure 8 The Vast Invisible interactive exhibit, as captured by a visitor to Invisible Worlds.

Overall, the process of BUILDING A NARRATIVE with regards to the Centrepiece seems to have been relatively more flexible than Vast Invisible, which had extensively specified content. Early in the process, the intended narrative direction for the Centrepiece was that the artwork would provide:

> *an overview of the interconnected environments - bringing the invisible into sight… why it is important to understand this delicately balanced and interdependent system (Invisible Worlds Narrative Overview Version 2, no date).*

As such, the centrepiece would draw together concepts from all other areas of the exhibition. The narrative remained in this relatively loosely defined form and soon, work began on ACTUALISING THE NARRATIVE when the decision was made to work with an agency to commission the artwork. Vast Invisible, by comparison, came about after the narrative content of the Wellcome bid was re-packaged into the 'Gateways', to provide an entry-point for the exhibition's content,

> *The Vast Invisible explores the journey of the materials we are made of (carbon, oxygen, water, nitrogen, phosphate) following their threads, transformations and cycles from each of us out into the vast environments of air, water, soil, rock and life; around about and back again. (Invisible Worlds Narrative Overview Version 2, No Date)*

This content was then later further structured into a 'primary goal' which,

> *Visualises an overview of the world and your place within it. Highlights: the connections between you and the world's vast environments, some of the current human-imposed challenges and potential solutions. (Invisible Worlds Narrative Overview Version 3, 20/11/17)*

This revised version included a 'content summary', including 'You in the bigger picture' about visualising the chemical components of the human body and how they are exchanged with the Earth's systems, and 'Bringing the bigger picture into view' about observational science, satellites and computer modelling, as well as a 'method' of using an interactive and immersive digital exhibit.

Unlike Infinity Blue, the narrative content of Vast Invisible was therefore specified in detail in advance of the commission, perhaps motivated by the content being characterised as highly difficult for visitors to understand,

> *The challenge we've given to the design team is to communicate process and cycles, which is one of the most difficult things for people to understand, and they haven't ever understood it to date, in a visual form.' (Director of Interpretation)*

Furthermore, it was suggested that working with design agencies rather than artists meant that the Eden Project could have relatively more control over the structure and content of the exhibit. This control was however not without risk, as the exhibition's Curator described how using digital interactives stretched their expertise,

> *There's a lot of unknowns... I keep questioning, 'Oh, do I completely understand what they say they're going to deliver? … Are they going to deliver what's in my head?' … I have a, you know, quite a lot of experience and a strong understanding of working with more mechanical stuff. So there is, kind of, you know, a bit of a learning curve. (Curator)*

Both the Centrepiece and Vast Invisible were selected by a commissioning panel. However, there were notable differences between each process. From early on, the team were conscious of the role that the Centrepiece would play in their POSITIONING within the art world, wanting to position themselves as 'mavericks', as discussed. There was discussion over whether they should work with a curator rather than an agency and the impact this would have on the Eden Project's reputation. The team sought clarification from the board, further highlighting the strong direction coming from senior leadership.

The strong level of direction around the Centrepiece indicates a seemingly lower level of trust and autonomy granted to this aspect of the exhibition than other areas. The Centrepiece was seen as hugely risky due to its high cost, and the unpredictability of working with artists. To legitimate the decision-making process, an arts panel was established consisting of senior staff at the Eden Project as well as external advisors, bringing members of the board directly into the decision-making process. The first delay, however, came when a member of the board was unable to attend the first meeting to review the long list of artists chosen by the commissioning agency,

> *Ray [board member] wasn't available to come to that first longlist meeting, so we had to delay it. And so, the whole ending when they were banging out those tiles [to construct Infinity Blue], the tile*

> *contractors were, and Charlie and Alex had to go up and sort them out. That process, that challenge started when Ray couldn't come to that first meeting. (Director of Interpretation)*

As the Director suggests, the commissioning process was unable to continue without this key member of the senior team, and the resulting two-month delay had a lasting impact throughout the exhibit's production. As I noted at the time,

> *There is some concern that the turnaround from commission to completion is very short. The attitude from the Head of Policy is that we will cross it when we come to it. (Field Notes from Meeting 28/06/17)*

This time pressure was acutely felt throughout the commissioning process and limited the options available to the team. On shortlisting the artists, the team quickly realised they would need to moderate their ambition of the Centrepiece artwork, as shown in the following exchange:

> ***Director of Interpretation:*** *And we didn't know, we shortlisted those four artists and then when they presented back to us, the first three, by the time the first three had presented back…*
>
> ***Curator:*** *Oh, I thought we were completely screwed.*
>
> ***Director of Interpretation:*** *I thought we were screwed.*
>
> ***Interviewer:*** *Oh, right.*
>
> ***Curator:*** *Oh, yeah, no, I thought we didn't, we would come out of that room…*
>
> ***Director of Interpretation:*** *I wanted to be sick.*
>
> ***Curator:*** *…without anything that was worth the money.*
>
> ***Director of Interpretation:*** *Yeah, I thought, I thought I was going to be sick.*

Despite the team at the time giving the impression that they 'seemed to like all of them' (Field Notes from Meeting 09/08/17), behind the scenes it was highly emotionally charged with stress and disappointment as they realised that the established artists they had shortlisted would be either unwilling or unable to complete such a large commission in a short amount of time and on a limited budget. The resource restrictions limited the choice to a collective of less well-established

artists who ‘didn’t know it couldn’t be done’ (Director of Interpretation). These ‘young’, ‘hungry’ artists on the one hand were willing to fulfill the commission, whilst on the other hand were a highly risky choice. This risk was however perceived to be worth it, as working with these artists served to maintain the ambition frame and position the Eden Project in the art world in spite of limited resources.

Vast Invisible, similarly to the Centrepiece commission, was judged and selected by a panel, this time consisting of Eden Project staff. However, rather than being selected by consensus as with Infinity Blue, time and budget constraints led to a design agency being selected which had not been chosen by consensus. This led to some division of opinion in the team. While the Curator said she ‘felt quite comfortable that they were the right choice’, not everyone felt similarly,

> *One of the things that I found a little bit frustrating… we didn’t feel that we had much input into the exhibitions bit. Do you remember when we had that huge great big meeting up in the gallery and we scored all the, all the submissions for the [exhibits]? … And then they were chosen... As far as we were concerned it wasn’t, sort of, as it was scored. And we were just like, ‘How? How did that happen?’… Because it, just everybody was just like, ’What? We ended up with that, but we didn’t want that.’ (Head of Policy)*

As the Head of Policy describes, there was confusion over the decision that had been made and concern that the design selected might be ‘best of a bad bunch’ (Coordinator). This first challenge in the exhibit’s production posed a threat to the ambition frame from which it was difficult to recover.

While Vast Invisible had a more directed narrative, the narrative aspect of the Centrepiece was refined in collaboration with the artists. From its initially very broad remit, on commissioning the artists it was narrowed to,

> *Commissioned artwork that pays homage to one of the smallest microbes that evolved around 3bya and made the biggest difference to the Earth – changing it forever (Invisible Worlds Narrative Overview Version 3, 20/11/17)*

and was set to be finalised when the artists presented their final design. The artists began working directly with some of the exhibition’s scientific advisors, lending scientific credibility to their work. Vast Invisible on the other hand involved a more

formalised process 'based on timelines and milestones' (Curator). That is not to say that the Centrepiece was not also working towards a deadline, which became acutely apparent when a problem with fabrication arose, leading to an un-anticipated three-week delay resulting in working 'right up to the wire' (Meeting Minutes 16/05/18). However, the team's dis-satisfaction with the production of Vast Invisible was reflected in the more dispassionate way of working of the 'London design team', who, 'wanted to bring in a pre-fab science centre thing without hanging around' (Policy Development Manager). This led to the agency being labeled in a way that 'didn't feel Eden'. While the way of working with the artists on the Centerpiece therefore allowed the maintenance of ways of working which felt more 'Eden', in spite of the formalised commissioning process, the professionalised mode of working with the design agency did not. Working with the agency therefore added a second threat to framing *Invisible Worlds* as ambitious.

Unlike Vast Invisible, whose narrative was documented throughout the production process, the more incisive involvement of members of the board and desire to position the Eden Project within the art world with regards to the Centrepiece made it apparent that the reaction of those at the launch party was highly important in checking whether it had met its ambition. Responding to the rather disappointing evaluation of an art critic, a member of the team remarked,

> *A very well-known curatorial eye says it's not art. And that's fine. It's like, great, it doesn't have to be because we're not an art gallery… But somewhere, someone might go, 'Well you didn't smash the art ambition.' (Invisible Worlds Team Member)*

The lukewarm response from a representative of the art world threatened the Eden Project's position in that world and claim to ambition. The team member responded to this threat by re-positioning the Eden Project as separate from art galleries, de-legitimising the critique. Later in the discussion, the Director of Interpretation further supported this positioning, saying, 'I think we are being risky… and it's quite fun actually. I hope we can act as provocateurs in the art world.' Taken in the sense of *agent provocateur*, the words the Director uses minimise the threat to the positioning of the Eden Project as a legitimate actor in the art world by implying they are instead infiltrators. If what they are doing is not art, it is because it was never meant to be art,

but rather an incitement to the art world, using art in a supposedly new and unique way. By so doing, it becomes possible to frame Infinity Blue as not only meeting its ambition, but 'busting' (*Invisible Worlds* Team Member) it.

By comparison, it was not possible for the team to re-position Vast Invisible as ambitious. The form of an interactive exhibit aligned the exhibition with other science centres, which 'all look the same' (Policy Development Manager), running counter to the exhibition's positioning as innovative and unique. The team managed this disappointment by distancing themselves from and apportioning blame to the design agency, as the Director of Interpretation explains:

> *What's really interesting in that a lot of companies, Eden being a company in this instance, work with external agencies, work with external design companies, who come in and go [raspberry noise] and do something and then they fix it. People look at our stuff and say, 'Ooh, it's different.' And one of the reasons it's different is we don't do that. So, I think the reason that we did that, the reason, what we've learned from that is we're not as keen to go to the London design teams because we're trying to set ourselves apart from that. (Director of Interpretation)*

While not being able to maintain the ambition frame, distancing nevertheless reinforced the less formalised 'Eden' way of working. Vast Invisible provided evidence that the normal science centre approach does not work and justified past avoidance of using interactive digital technology.

5.5 Chapter Summary

Beneath the linear exhibition production process, *Invisible Worlds* was supported by the enabling process of NEGOTIATING AMBITION. This set of interrelated tacit processes framed *Invisible Worlds* as ambitious, strategically positioned the exhibition and the Eden Project within a social arena, and tried to maintain these framings and positions within their resource-limited context. While this work may have been vital in allowing the exhibition team to secure resources and maintain their practices, I contend that NEGOTIATING AMBITION, by shaping constructions of visitors, also significantly influenced the production and form of the exhibition itself.

6 Visitor Data Generation and Analysis

Having described the methods and findings covering the organizational aspects of *Invisible Worlds* in the previous chapters, the thesis now moves to cover the visitor-focused portion of the present study. This chapter provides an overview of the methods used in the visitor-focused aspect of the *Invisible Worlds* action research used to address the research question developed during the Delphi process. The aim of the visitor research was to gain a deeper understanding of *transformation*, guided by the sensitising question, 'What aspects of the *Invisible Worlds* exhibition design create transformation in visitors, and in what ways can this be promoted and increased?' (research questions 1.b. and 1.b.i.). The visitor study resembles more traditional qualitative research, providing a representation of visitors' experience to the *Invisible Worlds* team (Genat, 2009). The in-depth qualitative approach adopted goes above and beyond what would be possible with the Eden Project's standard evaluation efforts. This aspect of the research consisted of photo-elicitation interviews with visitors to *Invisible Worlds* during their visit, with a selection of visitors taking part in a second interview between six and nine months after visiting. The sampling strategy, participant characteristics, and methods are outlined, before moving on to discuss the application of grounded theory analysis in this section of the research.

6.1 Sampling Strategy and Participants

Little attention has been given in the literature to issues of sampling in qualitative visitor research. While principles of sampling in qualitative research generally, and grounded theory specifically, still apply, the unique context of doing research with museum visitors *in situ* presents several specific challenges to quality and rigour. Primarily, visiting a museum is a leisure activity and participating in research is likely low on visitors' agendas. The implication for qualitative visitor research is anticipated low response rates and superficial data. In addition, conducting visitor research *in situ* presents a threat in terms of a doubly self-selecting sample, firstly in that participants choose to visit, and secondly choose to take part in the research.

These issues can be resolved by seeing each visitor as a 'case', rather than a representative of a larger population (Silverman, 2013). Yin (2017) explicates case study logic as necessitating selection of cases related to theoretical rather than statistical interests. Cases can allow study of the extreme and unusual, which can reveal insights about 'normal' process (Yin, 2017). In this study for instance, particular attention was paid to those cases where visitors had a particularly meaningful experience to understand how these experiences may influence 'transformation'. Crabtree, Tolmie and Ronncefield (2013) draw on the work of Harvey Sacks to assert that it is even possible to generalise from a single case. Using the example of the structure of a 'day out' of a single family, they argue that because theoretical description is always partial and can be extended indefinitely, even drawing on a single case allows for the elaboration of underlying order (Crabtree, Tolmie and Rouncefield, 2013). Using this logic of participant selection, no claims can be made about the prevalence, range or extent of a phenomenon, but analytic generalisation is possible to demonstrate its existence and understand its social organisation (Silverman, 2013; Yin, 2017).

The logic of case study research however relies on the availability of rich data, which allows for 'thick description' (Geertz, 1973). While it is not uncommon for grounded theory researchers to boast of interviews lasting several hours, time-poor visitors may not wish to stop for a prolonged period to take part in in-depth data generation. This study rather aligns itself with Kvale's (1996) assertion that even short interviews can have rich meaning if the interviewer knows what and how to ask. As detailed later in this chapter, several strategies were adopted to ensure that even a short interview provided rich data such as using photo-elicitation and providing a convivial interviewing environment (in the exhibition café with a plate of biscuits to hand). Follow-up interviews were used to allow a theoretical sample of visitors to elaborate on themes they had superficially touched on during the in-visit interview.

With the above considerations in mind, selective sampling (Coyne, 1997) was initially used to choose visitors to interview. The following sections elaborate on the selection criteria and how selective sampling progressed to theoretical sampling.

6.1.1 Inclusion Criteria

The research focus was around the sensitising concept *transformation*, as elaborated during the Delphi process (Section 4.2.1). This concept is cognate with Jack Mezirow's well-established transformative learning theory from the field of adult education (Mezirow, 2009). This transformative form of learning is posited to only be possible for adults because to change one's worldview, one must already have a more-or-less stable worldview to change (Illeris, 2014a). Additionally, there is empirical evidence that adults who visit museums with children may adopt a more facilitatory role, focused around the child's experience (Falk, 2009). While many visitor studies do not differentiate visitors, instead viewing 'visitors' as a generic whole, or focus exclusively on the perspective of a nuclear family unit, this research is more selective in its approach. Since one of the aims of this research is to re-conceptualise what it means for a museum exhibition to be 'transformative' through the creation of generative theory (Gergen, 1978), the sample of visitors was selected to maximise the opportunity to understand those most likely to experience the phenomenon. Following this logic, only adult visitors who were not accompanying children were selected to participate.

Interviews took place across several days of the Eden Project's 'shoulder' and 'peak' (school holiday and not school holiday) seasons as well as weekend and weekdays between June and September 2018. These times were chosen to capture a range of potential visiting conditions, such as different levels of busyness in the exhibition and motivations for visiting. Groups of adults were approached at the main entrance to the Core building and asked whether they would be interested in taking part in a study. It was explained that they would take a camera with them around the exhibition and could take photographs of whatever they wanted. As the study progressed, the prompt became more specific, asking visitors to take photographs to show what they had been *doing*, to reinforce the analytic emphasis on process. After they had looked around, taking as long as they wanted, we would meet again in the café to look through the photos together.

Of the groups approached, 25 agreed to participate. One of the main reasons for declining to participate was lack of time. Due to the Eden Project's landscaping, it is typical for visitors to go to the Core towards the end of their visit when they may be in a rush to finish looking around before catching public transport or moving on to other planned activities. Another common reason not to participate was lack of confidence in spoken English. The Eden project is popular with international visitors, but unfortunately their voice is absent from this study. More in depth research approaches may be better suited for studying those whose first language is not English (see e.g. Dawson, 2018). In addition to the main study, a small pilot of eight interviews was carried out in the Mediterranean Biome of the Eden Project in May 2018 using a similar procedure.

6.1.2 Theoretical Sampling

Theoretical sampling was enacted with visitors in three ways. Firstly, due to the open-ended nature of the photo-elicitation interviews, it was possible to theoretically direct follow-up questions later in the study as the analysis progressed (Charmaz, 2014). For example, initial analysis of the pilot interviews and first few interviews in *Invisible Worlds* highlighted the embodied nature of 'wandering around' in the exhibition, which combined cognitive, bodily, and sensory aspects. In later interviews, generic prompts such as 'tell me about this photograph' became, 'what were you thinking about?', 'what were you doing?', 'what were you looking at?', which allowed participants to further elaborate on their embodied experience. Further analysis indicated that while the photographs captured and prompted discussion of the 'focused' action of experiencing an exhibit, there was a lot of 'unfocused' action, or 'wandering' in between these points of punctuation. I further modified the interview to explore how and why participants moved from and between exhibits.

As the analysis progressed following the photo-elicitation interviews, I began to focus on visitors' reflections of significant life events as potential signifiers of deeper meaning. On this basis, participants were initially selected for follow-up based on whether they had drawn on or related to significant life events during their initial interview. Each follow-up interview was based around things that the participant had

touched upon in the previous interview. It was therefore possible to ask direct, theoretically-oriented questions, which still bore relevance and meaning to the participant (Charmaz, 2014), making the interviews a rich source of information to develop and saturate concepts. Serendipitously, a visitor who had not had such a meaningful experience was contacted and agreed to be interviewed. While he felt his wife had a deeply meaningful experience, he admitted that he had not. The interview proved to be analytically interesting in providing an alternative view and delimiting the scope of the phenomenon. After this point, I subsequently contacted other participants who, based on the developing analysis, I deemed unlikely to have had a deeply meaningful experience to further test my analysis.

As with the photo-elicitation interviews, it was possible to theoretically direct questions in subsequent interviews as the analysis developed. For example, in one of the first follow-up interviews a participant described visiting the Eden Project as part of a lifelong journey to feel and express a connection to the natural world. Pippa articulated stages in this connection, such as drifting away, strengthening the connection, and integrating it into her life. This discussion situated the concept of 'serendipitous wandering' as part of something far beyond the confines of the *Invisible Worlds* exhibition. Following this development, I began to frame each interview in the terms of visiting *Invisible Worlds* as a part of a larger 'life story', testing the fit of this interpretation with each participant in turn. One of these participants, who felt she had not had a deeply meaningful experience, spontaneously offered a comparison between the Eden Project and the Anne Frank Museum, explaining why one had been meaningful, and the other not. Seeing the analytical usefulness in this comparison, I began asking subsequent interviewees about other meaningful experiences they may have had, further testing the limits of my interpretations.

Using the above strategies to theoretically sample allowed the analysis to approach theoretical saturation. However, while the sample of photo-elicitation interviews was sufficient to develop *data* saturation, the number of follow-up interviews was limited by the number of participants still willing to be interviewed six to nine months after visiting. For this reason, data collection for the follow up interviews ceased before

theoretical saturation could be definitively established. This limitation does not foreclose the possibility of theoretical saturation, but it does mean that additional care had to be taken to establish theoretical claims. Section 6.3.4 discusses the theoretical sufficiency of the analysis in greater detail.

6.1.3 Participant Characteristics

The participants were all adults who were not accompanying children. In total, 33 groups agreed to participate (including in the Mediterranean Biome and *Invisible Worlds*), a total of 64 participants, 13 in the Mediterranean Biome and 51 in *Invisible Worlds*. Verbal consent to participate was obtained on entering the building, which was then confirmed by providing further information and obtaining written consent prior to the interview. Verbal consent was re-stated before the follow-up interviews. Contact details were provided so participants could express queries or concerns, or withdraw at any time. 33 participants identified as female, 30 as male, and one participant did not specify their gender. Tables 3 and 4 further summarise the demographic details of the participants including age, qualification levels and occupations.

There is a noticeable dip in participation from visitors in their forties. This may be due to visitors of this age tending to visit with children, and therefore being excluded from this study. The participants had in general achieved a relatively high level of education, with over half having a bachelor's degree or higher qualification. Using the age gap to split participants into two groups, younger than 45 and older than 45, all but three in the younger group had a qualification equivalent to a bachelor's degree or higher, while the older group had a wider range of qualifications, with 13 having a bachelor's level qualification or higher, and three having no qualifications. Participants' occupations match this pattern, with over half of the participants having professional or managerial positions. In the younger group, 22 had professional or managerial positions, while the older group had more variation, with 15 having professional or managerial positions, eight being retired, and two having no occupation.

	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65-69	70+	Not Stated	SUBTOTAL
No qualifications								1	1	1			3
Entry Level													
Level 1													
Level 2 (GCSE)								4	1	1	1		7
Level 3 (A-Level)	2	1								1			4
Level 4 (CertHE)									2				2
Level 5 (Foundation Degree)									1				1
Level 6 (Bachelors Degree)	7	5	4	1	1		1	1	1	1			22
Level 7 (Masters Degree)		4	1	2			2	3		1	1		14
Level 8 (PhD)			1				1		1				3
Not stated	1						2	1		1	2	1	8
SUBTOTAL	10	10	6	3	1		6	10	7	6	4	1	64

Table 1 Visitor participant demographics: Age and highest qualification level.

	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65-69	70+	Not Stated	SUBTOTAL
No occupation								1	1				2
Elementary occupation													
Plant and machine operator and assembler							1	1					2
Craft and related trades work		1											1
Skilled agricultural, forestry and fishery work	1												1
Service and sales work									1	1			2
Clerical support work										1			1
Technician and associate professional	3	3					1	1		1			9
Professional	6	6	6	3	1		2	4	1	2	1		32
Manager							2	1	2				5
Retired								1	2	2	3		8
Not stated												1	1
SUBTOTAL	10	10	6	3	1		6	10	7	6	4	1	64

Table 2 Visitor participant demographics: Age and occupation.

Despite clear age and educational biases in the sample overall, a wide range of participants were interviewed in terms of gender, age, education level, and occupation, providing useful data for constant comparison between cases. The splitting of the sample into two age groups equally provides useful stimulus for comparison between younger and older visitors. While there were many similarities between the experiences visitors talked about, each brought a unique perspective to *Invisible Worlds* by drawing on life experiences, stories, imaginations, and identities to make meaning from the exhibition. The sample, therefore, granted useful insight into the possibilities of meaning and experience in *Invisible Worlds* for these visitors, and how they situated the visit in their lives.

Of the initial sample of visitors, 36 were contacted for a follow-up interview and 10 agreed to be interviewed, two of them as a couple. In the final iterations of the analysis, the focus turned to these participants who provided additional rich reflections following the visit, before returning to the other interviews to test generalisations (Silverman, 2013).

6.2 Interviewing

While observational or survey methods are popular in visitor research, these methods rarely allow the researcher to apprehend visitors' deeper or more personal meanings. To this end, it was decided to use in-depth interviews, which are well suited to grounded theory analysis (Charmaz, 2014). In this approach the interview is informal and largely unstructured, much like a conversation, directed towards an understanding of the participants' 'central themes of understanding' or 'lifeworld' (Kvale, 1996). In all cases, interviews were transcribed verbatim prior to analysis.

6.2.1 Photo-elicitation Interviewing

In-depth interviewing in a museum exhibition context is potentially quite difficult. Visitors are unlikely to want to stop and talk for a prolonged period of time without significant incentive. The result could therefore be quite thin or superficial data, not conducive to in-depth qualitative analysis. To address this risk, the main interview method used in this study was photo-elicitation. This technique was chosen as an

engaging method, which would promote longer and more detailed interviews (Lapenta, 2011). The interviews were designed to be unstructured as far as possible (Charmaz, 2014) to reduce interviewer bias in selecting topics or themes, allowing the visitors to prioritise their own interpretations (Lapenta, 2011). The unstructured nature of the interviews was particularly important for the grounded theory analysis, where the researcher temporarily suspends their own theoretical inclinations, allowing the main concerns of the participants to direct the study (Charmaz, 2014). Photo-elicitation allowed for visitors to have control over the process (Guell and Ogilvie, 2015) by the only structure in the interview being provided by the sequence of photographs they had taken themselves.

Despite the advantages of using photo-elicitation in this study, several participants noted that the photographs could not fully capture what happened, particularly in relation to momentary or dynamic aspects of their visit. As Guell and Ogilvie (2015) emphasise, photographs are a limited means of representation, presenting a static moment in time and only capturing things which are able to be photographed. Nevertheless, photographs act as a memory prompt for participants, allowing them to elaborate on aspects of experience which may otherwise go unmentioned (Guell and Ogilvie, 2015). A particular strength of photo-elicitation in addressing how visitors may be 'transformed' is the ability of this method to capture the embodied, material, and spatial, allowing participants to reveal things unanticipated by the researcher (Allen, 2011). Through the interviews, the meanings of the captured images are created and explored (Harper, 2012), allowing *Invisible Worlds* to be both literally and figuratively 'seen' from a visitor's point of view (Lapenta, 2011).

In this study, the scientific accuracy of visitors' statements was of little importance. While many visitor studies attempt to assess visitors' 'learning' in terms of recall of scientific facts, attention was given rather to the meaning and theoretical plausibility of what visitors said (Charmaz, 2014). This approach acknowledges that scientifically incorrect knowledge is nevertheless part of participants' social reality, and therefore has consequences for action (Kvale, 1996). In some cases, visitors offered glossy accounts of facts they had learned, and neat lists of the pros and cons of the exhibition, without going beyond surface meaning. Rather than being concerned with

whether these accounts accurately represented their experience (Yanos and Hopper, 2008), their performative and narrative properties were considered (Atkinson and Coffey, 2011), providing data on theoretical possibilities (Charmaz, 2014).

The photo-elicitation interviews continued until data saturation was reached (33 interviews, 63 participants). Data saturation, in contrast to theoretical saturation, is when further data collection adds no new categories to the analysis.

6.2.2 Follow-up Telephone Interviews

Following data saturation in the photo-elicitation interviews, follow-up telephone interviews were used to theoretically develop the analysis. The aim with the interviews was to probe deeper into themes mentioned in the initial interviews without the time restrictions of being in the visit, whilst also allowing visitors to reflect back on the visit now several months had passed. Research on the usefulness of telephone interviews is mixed. For example, Irvine (2011) found that telephone interviews allowed for less detail and elaboration in responses, while Sturges and Hanraham (2004) found that telephone interviews produced the same amount and quality of data. Both Irvine (2011) and Novick (2008) advise using strategies to 'warm up' the participant and develop rapport, to ameliorate the potential negative effects of talking on the telephone. In this study, however, it did not seem arduously difficult to have an in-depth and meaningful interview. The ease of conducting these interviews may be because I had already spent a considerable amount of time with participants during their visit. Using an in-depth method during the visit which shows genuine concern to listen to visitors' experiences likely paid dividends when conducting the follow-up interviews. Furthermore, the visitors followed up invariably looked back on the visit fondly, so seemed to enjoy reflecting back.

While the telephone interviews were fairly short (around 30 minutes), because I followed up on particularly meaningful aspects of the visit which they had previously mentioned, as well as focusing on theoretically pertinent themes from the developing analysis, they contained rich meaning (Kvale, 1996). In the first few interviews, I opened the interview by asking participants what they 'remembered' of their visit,

which typically elicited a list of things they had seen with little comment. It was eventually much more fruitful instead to ask participants to 'reflect on' their visit, prompting a discussion of thoughts and feelings. The interviews then moved on to more individually oriented questions, asking the participant to elaborate or reflect on something they had mentioned during the visit. In some cases, I strategically used leading questions as an analytical tool to test the strength and limits of my interpretations (Kvale, 1996). Most follow-up participants were selected because they had linked the visit to a significant life event. I used the follow-up interviews to elaborate how those events arose, where they were imagined to take the participant in the future, and what role (if any) visiting the Eden Project played in that process.

6.3 Analysis

The analysis of the interviews followed constructivist grounded theory, which is based in the tenets of pragmatism and symbolic interactionism (Charmaz, 2014). This form of analysis is suited to understanding process and meaning, and ultimately aims to generate theory around a substantive context. The following sections reflect on the development of analytical concepts by showing how core aspects of grounded theory analysis, such as constant comparison, open, focused, and theoretical coding were applied to the visitor interview data.

6.3.1 Mediterranean Biome Pilot: Open and Selective Coding

Analysis began following completion of the Mediterranean Biome pilot. Charmaz (2014) recommends line-by-line coding at this early stage of analysis, however in the organisational aspect of the research I had found that doing so breaks up the data into arbitrary chunks, and quickly leads to an overwhelming number of codes. Instead, rather than relying exclusively on line-by-line coding, I coded meaningful segments of the interviews, using gerund (-ing word) codes and *in vivo* codes as far as possible to ground the analysis in process and visitors' experience. After this initial process of coding, I quickly moved to focus the analysis by selecting and grouping codes.

Many of the visitors had explained in one way or another how they were 'just wandering around'. It was interesting that visitors had a sense of wandering, despite walking a set route. Based on my initial analysis, I noted that WANDERING was an embodied process, consisting of an interaction between a WANDERING BODY, WANDERING MIND, and WANDERING EYE. As such, it was not just that visitors were physically wandering around the space, but that they were also relying heavily on visual and other sensory cues, as well as drawing on IMAGINATION and MEMORY (Figure 13).

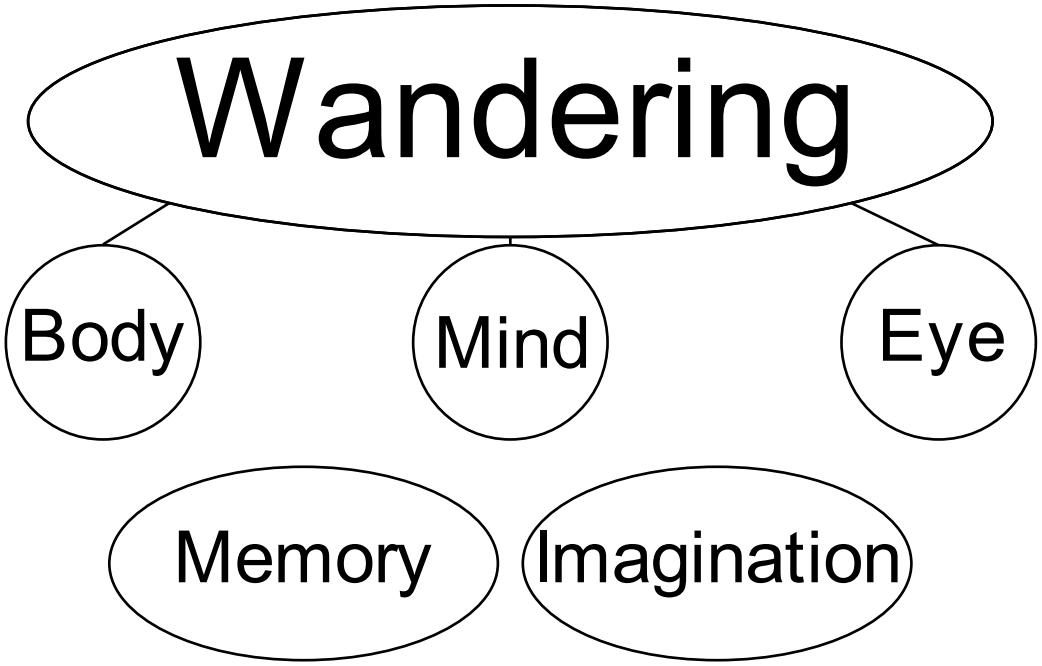


Figure 13 The initial coding framework developed from the pilot interviews in the Mediterranean Biome.

At this stage, I used brief memos to explore my initial interpretations. I conceptualised the WANDERING BODY as somewhat self-explanatory, wondering how physical wandering related to memory and identity. Transitions between different areas of the exhibition seemed to provoke comparisons between aesthetic aspects of the exhibition, so I questioned how other stages of bodily wandering may play a role, such as coming in, standing, moving on, and moving between zones. The WANDERING

MIND, I tentatively imagined, enters with no pre-conceived ideas and is open to allowing itself to be diverted by associations as the visitor wanders around. WANDERING becomes wondering, as visitors engage in recalling prior knowledge, relating to themselves and their lives, and indulging curiosity. The WANDERING EYE is about looking – up, around, through, at – but not looking *for* something. Aesthetic aspects of the exhibition drew the eye, as well as things which visitors were able to relate to themselves. Looking in this sense is both macro, looking at the bigger picture, as well as micro, focusing in on the details. It is about being in the moment, when a shift in light can change what is being looked at from one moment to the next. Taken together, I conjectured that WANDERING creates a sense of being in a special moment.

The visitors I initially interviewed seemed to be making sense of the exhibition through REMEMBERING and IMAGINING. Remembering, I hypothesised, made sense of the exhibition by relating the exhibition's contents to the self, through recalling facts, or memories of significant life periods or events. These memories seemed to be 'triggered' by looking and walking around. Similarly, IMAGINING formed part of the embodied process of wandering by transporting the visitor somewhere else. The visitor could be transported to nature, away from people, to the distant past, to an alternative past self, or to the distant future. For some, this imagination came across as immersive, whilst others actively chose to suspend disbelief for the enjoyment of the experience.

Whilst making these initial interpretations and assertions, I was nevertheless aware of their very tentative nature based on the limited data I had generated thus far, as well as the different context of this exhibition compared to *Invisible Worlds*. I decided to suspend the analysis pending the interviews in *Invisible Worlds*, only bringing the ideas from the Mediterranean Biome interviews for case comparison at a later stage in the overall analysis.

6.3.2 Initial Invisible Worlds Interviews: Open Coding

Analysis of the *Invisible Worlds* interviews began from the outset, noting initial thoughts and interpretations during data generation. It was possible to iterate between data generation and analysis by conducting the interviews in one-week 'blocks', before returning from the field to transcribe and analyse. Despite previous reservations about line-by-line coding, I started the analysis with in-depth line-by-line and micro-analysis of the first five interviews. Corbin and Strauss (2015) define micro-analysis as a detailed form of open coding in which the analyst interprets varied meanings of a word or phrase. Used selectively at the beginning of analysis, this technique is useful in generating and exploring ideas (Corbin and Strauss, 2015). This process provided rich detail on the interactional processes which visitors were using in *Invisible Worlds*. I sorted the initial codes to remove or combine repeated or semantically similar codes, to create a number of open codes, shown in Figure 14-

Admiring labour	Having attention grabbed
Aesthetic experiencing	Interest
Appealing to rhetorical or discursive others	Knowing, understanding
Becoming fatigued	Regressing
Being open or closed to learn	Seeking information
Enjoying a special moment	Testing the limits of technology
Finding environmental values	Vicarious experiencing
Finding familiarity	Wandering
Going through the motions	

Figure 9 Open codes generated from an initial analysis of visitors to Invisible Worlds.

While WANDERING, as developed following the Mediterranean Biome pilot, re-appears in this initial analysis, its priority over other codes was removed, to allow for other possibilities and interpretations in this new setting. While some of the codes at this stage were fairly descriptive, others, such as VICARIOUS EXPERIENCING, already felt analytically significant. VICARIOUS EXPERIENCING encapsulated an awareness of being with other people in the exhibition and watching others, particularly children, play. Visitors described a sense of excitement, particularly around the centrepiece sculpture Infinity Blue as crowds gathered to watch it.

6.3.3 Invisible Worlds Interviews: Focused Coding

Following the detailed analysis of the initial interviews, analysis moved towards more focused coding. To initiate this iteration of coding I decided to focus in on developing two new codes and their interaction, namely SIGNIFICANT LIFE EVENTS, and AWARENESS OF OTHERS. The reason for choosing SIGNIFICANT LIFE EVENTS as a focus was that those visitors who framed or related their visit in terms of a significant life change seemed to have had a more deeply personally meaningful experience. Directed by the sensitising concept of *transformation* as a change in how visitors see the world, I hypothesised that it may be these visitors who were most affected by their visit. AWARENESS OF OTHERS presented itself as being analytically interesting because it was a new code from the *Invisible Worlds* interviews which had not been apparent in the Mediterranean Biome interviews. Visitors referred to other people in the exhibition, as well as non-present 'others' in both a specific and general sense.

Focused coding involved going through the interviews thus far, paying particular attention to SIGNIFICANT LIFE EVENTS and AWARENESS OF OTHERS. NVivo was useful during focused coding to compare instances of each code within and between interviews, allowing their variation to be delimited. This focused analysis led me to define SIGNIFICANT LIFE EVENTS as those events, such as changes in work, family, or self, which punctuate different phases of a person's life. These life events relate to a person's attitudes, values, interests and affordances. I hypothesised that those visitors who, through congruence with the exhibition, were able to constructively link the exhibition to significant life events, made sense of the exhibition in a more deeply

meaningful way. AWARENESS OF OTHERS combined both looking at and being with others in the exhibition, creating a sense of communal experience and shared emotion. I hypothesised that an integration of both relating to significant life events and heightened awareness of others allowed visitors to relate the exhibition to the wider world. I began to consider that transformative change, at least in the way that visitors were describing it to me, began long before the visit, and that through interaction with the exhibition, visitors were able to support that change in novel ways.

After this focused engagement with just two codes, I returned to a broader, more general analysis of the interviews. Based on the detailed analysis of the interaction between SIGNIFICANT LIFE EXPERIENCES and AWARENESS OF OTHERS, I generalised this process to encompass earlier ideas by conceptualising visitors' creation of deeper meaning as a feedback loop between a visitors' INTERNAL RESOURCES, and the EXTERNAL RESOURCES (PHYSICAL, TEXTUAL, VISUAL, SOCIAL) provided by the exhibition. I anticipated that this creation of deeper meaning was part of the process of WANDERING, mediated by ATTENTION. Going back through the interviews, I identified EMPATHY, IMAGINATION and MEMORY as important 'resources' which visitors used to try to make sense of *Invisible Worlds*. These categories superseded the previous analysis of visitors drawing on SIGNIFICANT LIFE EVENTS to be more general, including how visitors drew on prior factual knowledge, memories, as well as imagination of themselves and others. In the same way, I conceptualised EXTERNAL RESOURCES as parts of the exhibition, PHYSICAL, TEXTUAL, VISUAL, and SOCIAL, which visitors were able to use make sense of the exhibition. While other people in the exhibition space remained important, I broadened the focus to also include the designed elements of the exhibition.

6.3.4 Follow-up Interviews: Theoretical Coding and Theoretical Sufficiency

While it was possible to theoretically sample developing concepts during the follow-up interviews, the limited response from participants meant that data generation stopped before theoretical saturation could be definitively established. Theoretical saturation, and saturation generally, remains a controversial issue in qualitative

research, being described as ‘mysterious’(Aldiabat and Le Navenec, 2018), and deceptively simple (Morse, 2007). Many authors claim they have reached theoretical saturation, without providing evidence that this is the case (Bowen, 2008). Dey (1999) even goes so far as to question the legitimacy of theoretical saturation as a concept altogether, suggesting saturation is merely conjecture. Instead he recommends ‘theoretical sufficiency’ as a measure of quality of grounded theory (Dey, 1999), arguing that it is always possible to discover something new. It is certainly arguable that the concept of theoretical saturation may represent a version of naïve empiricism by assuming that there is a theoretical ‘reality’ which can be fully known with sufficient data. Instead, saturation may simply represent the point when the researcher has reached the limits of their imagination, analytic ability, and resources. More recently, Malterud and colleagues (2016) have suggested ‘information power’ as an alternative concept to saturation, which takes into account the richness of information provided by participants. Information power recognises that theoretical sufficiency depends not just on data quantity, but on its quality and specificity, the aims of the study, theory, and analysis. This study aligns itself more closely with the notions of theoretical sufficiency and information power than ideas of theoretical saturation. That is to say that concepts developed through grounded theory methodology are more generative in nature than propositional. The aim of this study being to challenge assumptions about visitor experience and provide alternative ways of thinking and doing (Gergen, 1978).

The follow-up interviews were used in the analysis to test out the hypothetical relationships between concepts generated in the thus far, filling in the gaps and developing theoretical sufficiency. Topics which visitors had mentioned during the visit could be brought up again to see if they still held significance now it was several months later. Through this more in-depth discussion, we re-visited the SIGNIFICANT LIFE EVENTS which had become a focus of the analysis. With a smaller number of participants, the analysis focused in on their individual stories. By doing so, I was able to draw links between how visitors made sense of *Invisible Worlds*, and how they located their visit within the broader context of their lives.

6.4 Chapter Summary

This chapter outlined the methods used in the visitor-facing aspect of the research, used to create generative theory around the sensitising concept of visitor transformation. It explained the logic behind participant selection, as well as the strategies used for theoretical sampling. In-depth interviewing approaches during and after the visit, including photo-elicitation, provided comprehensive data on the meaning of visitors' experience in *Invisible Worlds* and the place that visiting the exhibition had in their lives. The application of constructivist grounded theory analysis to this data was discussed in detail. The following chapter details the results of this analysis.

7 Visitor Study Findings: Making Sense of Invisible Worlds by Serendipitous Wandering

This chapter looks at the processes by which visitors to *Invisible Worlds* made sense of their experiences in the exhibition, summarised by the overall concept of 'serendipitous wandering'. This concept emphasises the embodied and contingent nature of making sense. It addresses the strategies, resources, and affordances which visitors used to understand the exhibition and how, by extending this understanding beyond just the immediate context of the exhibition itself, some visitors were able to create a more deeply meaningful experience. This deeper meaning is explained as an ability for visitors to relate to their experience beyond the confines of time and place which define a 'day out' to integrate their experience in the exhibition into an ongoing narrativised account of a significant life change, or 'life story'. This chapter directly addresses the research questions:

b. What aspects of the *Invisible Worlds* exhibition design create transformation?

    i. How could transformation be promoted or increased?

The chapter begins by addressing visitors' anticipation, which provides an affective framing for the visit. It then moves on to look at the process of WANDERING AROUND, which describes visitors' attempts to make sense of the exhibition. Emphasis is placed on the relationship between embodied ways of knowing and cognitive understandings, particularly the relationships between vision, movement, and touch. I argue that understanding of the exhibition is in part a skill, an ability to 'read' the exhibition's affordances and make meaningful links across disparate areas of memory and imagination. Finally, the chapter moves to focus on how some visitors were able to integrate their experience into an ongoing life story in a way, which directly addressing the research questions above, may support transformative change.

7.1 Anticipating the Visit

Participants' reasons for visiting the Eden Project were characterised by a general sense of positive anticipation of varying intensities. For example, Samuel described how the remote location of the Eden Project prevented him visiting for a long time, '…we've always wanted to come here, but it's too far to come. It's 250 miles each way. To drive for a day is a long way, and we don't come down to Cornwall' (Samuel, 55-59, Company Director). This extended delay in visiting due to the attraction's inaccessibility served to heighten Samuel's sense of anticipation. In fact, most of the interviewed visitors came to the Eden Project with a strong sense of excited expectation, and many described having 'always wanted to come', having heard or read about the Eden Project, in some cases for many years. Often, visitors associated the decision to finally visit as a confluence of enabling factors, such as having spare time due to retirement, being in the area for other reasons, or celebrating a special occasion. As Patsy put it, 'While we're down there, why don't we go to the Eden Project?' (Patsy, 35-39, Teacher). And while Patsy's phrasing may, at a surface level, seem offhand, for many visitors visiting the Eden Project was the fulfilment of many years' anticipation.

However, beyond the emotional sense of anticipation, the visitors interviewed in this study were otherwise ambiguous about their reasons for visiting. Rather than suggesting that visitors have strong leisure motivations based on identity (Falk 2009), this research suggests that these motivations may be much less extensively developed. This lack of specific 'motivation' is highlighted by Adam, who, when discussing reasons for visiting, said,

> *It was my idea. I didn't quite know what to expect, but I read somewhere that it's quite impressive installations and that the greenhouses that they have here are quite unique, so we just tried to check it out. But honestly, we didn't quite know what to expect. So, we just kind of dropped in and saw what we found. (Adam, 30-34, Engineer)*

Despite having an affective expectation of being impressed, Adam did not have any specific cognitive expectations about the visit. This highlights the importance of the affective dimension in framing the visitor experience.

The exception to the general pattern of ambiguous but excited expectation was Abby, a radiographer in her late twenties, who had visited the Eden Project five or six times before. Abby described the Eden Project as 'one of my favourite places to be… I just like the, how much green there is. It's super relaxing' (Abby, 25-29, Radiographer). She was the only person who, knowing the Eden Project well, expressed prior interest in specific aspects of the visit, including the new *Invisible Worlds* exhibition. Abby's experience suggests that more developed motivations for visiting may be a result of familiarity with the site specifically, or with cultural sites in general. It is possible to hypothesise, therefore, that visitors' more specific motivations may be a function of cultural capital, in that it confers the ability to identify *a priori* the affordances that visiting a site such as the Eden Project might offer. In contrast to Abby, most of the interviewed visitors' un-formed motivations for visiting suggest a sense of ambiguity, despite anticipation.

While Abby's experience marks one extreme of a continuum, she was not the only person who had visited the Eden Project before. Most participants were visiting for the first time, but some were returning, often after many years. Anna described,

> *I came ten years ago. And I wanted to see what changes there were. Because when I came ten years ago, I thought it was absolutely fantastic and I knew that it was in the early days and still more to do. And I just wanted to see what the changes were. (Anna, 70+, Retired)*

Like Anna, those who had visited a long time ago were returning to see what had changed since the Eden Project had first opened, now it is more established. Those who had visited more recently had a less excited sense of anticipation, wanting to repeat a past enjoyable experience, while some of those re-visiting Eden were bringing others with them who they thought would enjoy the experience.

However, not everyone anticipated the visit so positively. There was a general pattern that one or several members of a group would direct the visit, while other members of the group were 'along for the ride', as the following exchange between Sharon and her husband Brian, who previously exclaimed that 'I've come here to drink beer', demonstrates:

> ***Sharon:*** *And I said I was coming here. Somewhere I just heard about it so many years that I just wanted to come, so I just heard it was good so, so then I just dragged him along.*
>
> ***Brian:*** *I'm with her.*
>
> *(Sharon, 55-59, Civil Servant, and Brian, 55-59, Coach Driver)*

Therefore, while in general visitors entered with a sense of anticipation, this was not always to the same degree or evenly distributed amongst visitors, particularly in larger groups.

Nevertheless, all visitors interviewed were visiting the Eden Project as a day out either on holiday, a long weekend or other trip. The Eden Project was seen as something unique to do in Cornwall, as exemplified by Gary:

> *I felt like, as well, the Eden Project's... when you think about Cornwall, that's a very big part of, I'd say, Cornwall. It's definitely one of the three things to do in Cornwall I would say, like my own, personal list. (Gary, 20-24, Film-maker)*

Overall, visitors' sense of anticipation, regardless of degree, acted to provide an affective frame for their visit. The anticipation of visiting created a positive affective expectation, which defined the situation as a 'day out'. This finding highlights the importance of a more ambiguous affective dimension in the build up to the visit, relative to specific cognitive motivations. As I argue later in this chapter, much of visitors' experience of the exhibition was shaped by attempts to resolve this ambiguity – TRYING TO UNDERSTAND. This is not to suggest, however, that ambiguity is in itself a negative thing. Ambiguity was responsible for creating anticipation, motivated visitors' engagement with the exhibition and allowed for serendipitous discovery, which led to visitors generating deeper meaning.

7.2 Wandering Around

Visitors came into the Core building with little pre-supposition about what the *Invisible Worlds* exhibition was about. Entering was marked by a sense of pause, as Tony explained when talking about first entering the exhibition, 'Just coming in the door you're like, "ok what's it actually about?"... So, [I] just took a second again to say, "ok, that's what's going on?"' (Tony, 25-29, Doctor). By taking a second, Tony

attempted to orient himself to the new space, seeking to make sense of ‘what’s going on’. This initial sense of dis-orientation was echoed by Patsy, who described her sense entering the exhibition as, ‘Just mostly going, “wow.” And not really understanding it at that point’ (Patsy, 35-39, Teacher). These quotes show how the transition into a new space can be an evocative moment which, shown in the case of Patsy, may provoke a strong affective response, as well as attempts at orientation and trying to make sense of what’s going on.

Interestingly, many visitors bypassed initial areas of the exhibition entirely, heading directly to the centrepiece artwork Infinity Blue. They often described this as the ‘first thing’ in the exhibition, despite having to walk past several other exhibits and interpretation panels to get there. This sense of Infinity Blue being the first thing in the exhibition hints at the importance of attention in shaping both visitors’ actual bodily movement as well as perceived sense of movement around the space, which is discussed further in Section 7.2.1.

In general, after entering, visitors consistently described themselves as ‘wandering around’ (Figure 15), moving through the exhibition without a pre-set agenda and being open to the experience. Unfocused movement was punctuated by moments of more focused action when attention was given to exhibits in a process of TRYING TO UNDERSTAND. The shift between wandering and more focused attention was moderated by a passive sense of HAVING ATTENTION DRAWN as well as active FILTERING of the exhibition's contents by visitors, which are described in later sections of this chapter.

The process of WANDERING AROUND, however, was not experienced identically across all interviewed visitors. While in general, wandering afforded for many a sense of

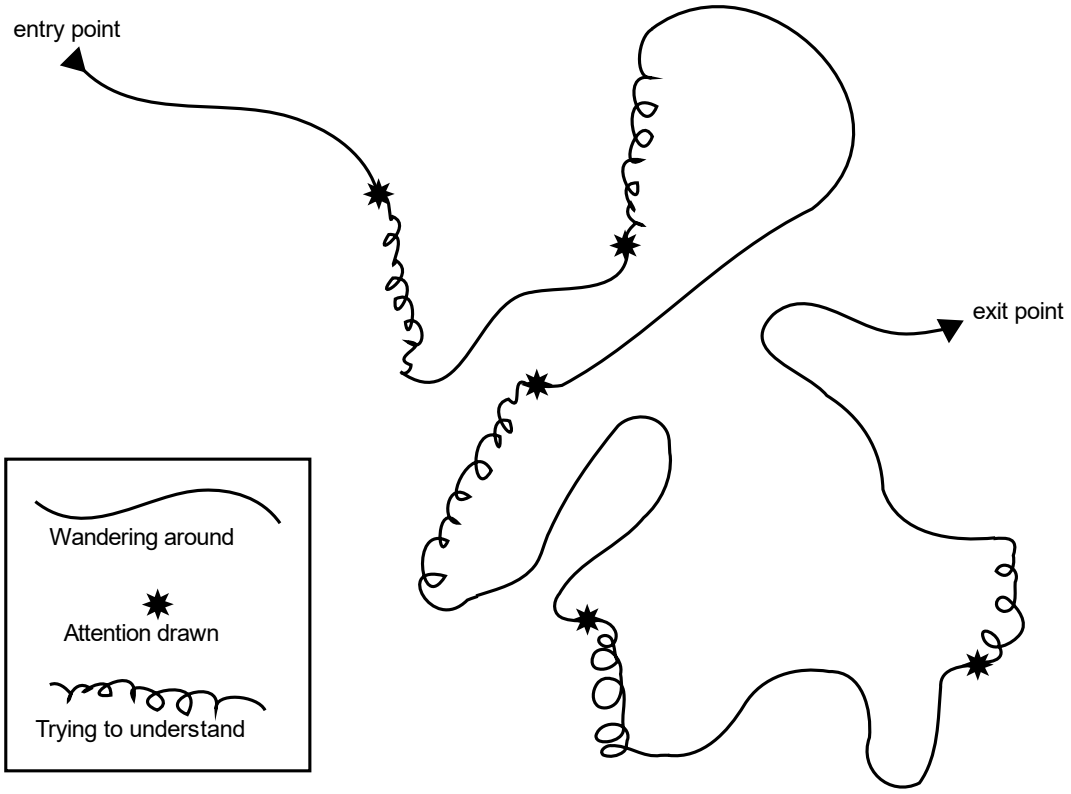


Figure 10 A conceptual illustration of the embodied process of serendipitous wandering in Invisible Worlds - Unfocused wandering around is punctuated by periods of focused attention and action, mediated by attention.

naturally being drawn around the exhibition from exhibit to exhibit, without a set plan or agenda, as Rosa describes, 'You just wander round and go, "Oh, we're going this way"... "Oh, shall we go this way?"... we don't plan that kind of stuff, do we?' (Rosa, 35-39, Social Worker), some visitors were more methodical and comprehensive in their approach. Tony, talking about how he decided to move from exhibit to exhibit said, 'I think we just wandered around, but tried to do it floor by floor. So, systematically as we went but not having a plan before going around' (Tony, 25-29, Doctor). Visitors' wandering therefore varied in its selectivity, with some visitors attending only to things which drew their attention, while others attempted to see and do 'everything'. The following exchange between Caitlin and her husband Glenn further exemplifies these contrasting approaches to WANDERING AROUND:

> ***Caitlin:*** *There were certain things I looked around and it didn't really take my focus at all, but certain things did. Things like the microbe and the bacteria, that kind of thing that really did.*

> ***Glenn:*** *No, I wasn't drawn to anything. I wanted to look at everything, to try and take it in, so I tried to look at everything a little bit and I said to you that I didn't understand a lot of it.*
>
> *(Caitlin, 55-59, Sales Assistant, and Glenn, 50-54, Driver)*

Those visitors who were more selective 'curated' their experience, like Caitlin, who was particularly drawn to content that challenged her existing conceptions of microbes:

> *…things that I didn't know and things that I had a different perception of, like with the bacteria, I had a totally different perception of that. I didn't realise it was that percentage. So, it's things that I've always perceived, but then reading these things, completely different to what I'd always been led to believe. (Caitlin, 55-59, Sales Assistant)*

Microbes, and her perception of them, became a central theme around which her sense-making in the exhibition coalesced. Glenn on the other hand, tried to 'look at everything' and found that, despite in the interview displaying interest in and recall of many aspects of the exhibition in detail, felt he 'didn't understand a lot of it'. Some visitors took selectivity even further - rather than allowing their attention to be drawn to appealing aspects of the exhibition, they instead filtered out much of the exhibition content entirely, which is described in more detail in Section 7.2.2.

Varying approaches to moving around the space indicate that while WANDERING AROUND at first glance seems prosaic, it is a skill which enabled some visitors to make sense of the exhibition by relating and creating continuity between physically dis-continuous aspects of the space. The variation between comprehensiveness and selectivity suggests there is a 'sweet spot' within which meaningful sense-making is possible. This finding highlights that the visitor experience is fundamentally embodied - that visitors make sense of the exhibition by moving around the space. *WANDERING AROUND* therefore highlights the contingent, spontaneous, and improvised way by which visitors came to understand the exhibition. The following sections further explicate how, through HAVING ATTENTION DRAWN and FILTERING, visitors were able to structure their wandering to begin to make sense.

7.2.1 Having Attention Drawn

Visitors' experience and direction of attention drove their movement through the exhibition space, as described by Niall:

> *…I think you spotted the thing, the big peanut sort of air blowy thing, yeah… Then you sort of went towards that because it looked cool and it looked interesting. So, I mean, something that catches someone's attention is bound to drag people towards it. (Niall, 20-24, 3D Artist)*

The word 'drag' which Niall used is evocative of the sense of compulsion and movement which was accompanied by a sudden focus of attention, which many other visitors described as feeling physically drawn to certain parts of the exhibition. HAVING ATTENTION DRAWN, however, was also characterised by a sense of pause, as visitors decided to 'stop and pay attention to things', 'stop and look and read', or just 'stop and feel it [the atmosphere]'. This alternating movement and stillness, driven by visitors having their attention drawn, was the way by which the unstructured movement of WANDERING AROUND became structured, paced and ordered.

Attention was primarily captured by visually striking and aesthetically appealing aspects of the exhibition, including scale, light, colour, and texture, which many described as 'eye-catching'. For example, Sharon described the appeal of the Seed sculpture:

> *'I think maybe the scale of those things drew me to it and also being able to see the texture of things. I think, for me, that was probably why I was more drawn to them because… I found them interesting to look at.' (Sharon, 20-24, Photographer)*

Beyond just being visually 'eye-catching', those aspects of the exhibition, which drew attention were those which visitors perceived to have desirable affordances. In the first instance, like for Sharon, aesthetically appealing aspects of the exhibition afforded close looking, which she found 'interesting'.

More broadly, visitors' attention was drawn when they perceived they were able to *do* something. As Molly explained, perceiving the affordances of the exhibition made her stop and pay attention:

> *'It just works in your favour to have things interactive, to actually have things to do because I think you actually stop and that's when you actually stop and pay attention to things… But if there's actually something for you to do there I'm more drawn to that and I'll go straight to that, which is probably why I'm more drawn to that sort of thing, because it's like… I can go and look at that, I can go and do that, rather than, yeah.' (Molly, 20-24, Designer)*

Molly's description neatly articulated how discernment of what it was possible to do in the space switched unfocused WANDERING AROUND to more focused activity. In this way, HAVING ATTENTION DRAWN changed visitors' movement through the exhibition – WANDERING AROUND became going 'straight to that', where you 'stop and pay attention to things'.

While for some visitors like Molly, interactivity was appealing in itself because it suggested affordances to do something active, for Hazel, interactivity offered the affordance of being able to take control over the pace and volume of information the exhibition provided. Feeling overwhelmed by much of the exhibition, which made her feel 'inadequate', Hazel explained how she was drawn to part of the Small Invisible exhibit:

> *So, this is the gadget which you turn, and it displays up on the wall. And that drew me in because it meant that I could actually interact with my learning. I could make it go as fast or as slow as I wanted it to. (Hazel, 50-54, Teacher)*

Hazel illustrated how the activity that we might expect an 'interactive' exhibit to afford (physical interaction) is not always the same as what visitors' want or perceive (control over the pace and volume of information). Conversely, it is important to note that it was not just 'interactive' exhibits that offered rich affordances to visitors. Joel and Sally above showed how detailed photographs afforded close looking, while others noted the interesting texture of the Seed sculpture 'invites you to touch it', and eye-catching text afforded reading which some visitors found aptly encapsulated and reinforced the meaning of the exhibition as a whole.

In addition to visitors focusing their visual attention on the exhibits themselves, another important strategy, which visitors used to discern the affordances of the exhibition, was paying attention to what other visitors were doing in the space. For

example, Charles described watching other people wave their arms around in front of the Vast Invisible exhibit:

> *This zone, part of it didn't get me, but this did because it drew me in to interact with it and see 'oh, those people are waving their arms around, what else can I do?'… So, this was interactive, something about it drew me in and I wanted more. (Charles, 50-54, Church Leader and Music Teacher)*

By seeing other people interact with the exhibit, Charles became aware of possibilities for interaction, which physically drew him closer. The frequent crowds of people around the centrepiece sculpture were also a point of focus in the exhibition. Tony, although uncertain about what the sculpture was, commented, 'It was a big eye catcher obviously, drew crowds who were just standing around and watching it for ages… It seemed like a lot of fun' (Tony, 25-29, Doctor). By watching the crowds, Tony thus determined that Infinity Blue was something where it is possible to have fun.

To a lesser extent, visitors were drawn to aspects of the exhibition they could recognise. For example, Anna was drawn to Small Invisible because she noticed a picture of blue cheese, a food she enjoys eating:

> *I saw the blue cheese, and I thought, 'I eat blue cheese, what's wrong with it? There must be something wrong with it if it's in this section dealing with bacteria'. And I was looking for more information about why blue cheese is blue and it didn't have that specific information, but it sort of drew me into the whole display about the bacteria and stuff. (Anna, 70+, Retired)*

The unexpectedness of the connection prompted worries about blue cheese, which piqued Anna's curiosity and drew her in to look at the rest of the exhibition. While Anna was unable to find answers to her questions, the image did act as a 'hook'. Unlike other modes of HAVING ATTENTION DRAWN, being drawn to recognisable content was relatively uncommon and superficial. As Anna demonstrated above, her recognition of blue cheese had little deeper significance beyond initially hooking her into the exhibit and her attention soon moved to other things. As such, while recognisable content was to an extent effective at grabbing attention, it had little power to sustain it.

In contrast, the centrepiece sculpture Infinity Blue was an exhibit some visitors found particularly compelling, and offered a strong example of how attention was maintained. Kimberly described Infinity Blue as ‘intimidating’ and ‘fascinating’, saying about the smoke rings the sculpture produces,

> *There’s one angle where the light was coming through the ceiling and they sort of changed there, at that angle, that side of it, the escalation to the other side. As the light caught them, they just looked completely different. (Kimberly, 55-59, Research Nurse)*

This ephemerality of the smoke rings and their interaction with the light sustained visitors’ attention, which created a sense of fascination beyond just an initial hook. The following exchange between Patsy and Rosa showed how the contrast between the rings’ ‘substantial’ form and temporary nature created a sense of a special moment, which had to be appreciated before it was over:

> ***Patsy:*** *Also, because they're so perfect… And they look so substantial. They don't look like smoke. They look tangible. Yeah, I don't know.*
>
> ***Rosa:*** *And then suddenly they dissipate. There's something about their, this isn't going to be a word, ephemeralness, ephemerality? That it's like, ‘get it before it's gone.’*
>
> *(Patsy, 35-39, Teacher, and Rosa, 35-39, Social Worker)*

Patsy and Rosa’s attention on Infinity Blue was maintained in this special moment, which, as Evie explained, ‘holds you there for a little bit longer ‘cos you want to see another [smoke ring]’. In this instance, Infinity Blue sustained attention through a powerful aesthetic experience where passive looking became active watching, accompanied by an intense feeling of fascination, mesmerisation or engrossment, to the point where, as Kenneth noted, one ‘could have sat there all day and watched that.’

Visitors’ fascination with Infinity Blue also highlighted the relational nature of attention. Rather than any one ‘factor’ being responsible, it was the relation between space, light, form, movement, and people which held visitors around the sculpture:

> *It's just the whole combination of the open space, the natural light, and this beautiful sculpture, which actually is interacting with its environment. The children playing around there trying to catch the*

> *smoke rings. Yeah, it was just a very nice place to enjoy… Just colours, form, movement, the atmosphere. (Rupert, 35-39, Surgeon)*

As Rupert illustrated, the unique combination of dynamic aesthetic factors created an 'atmosphere' which visitors found particularly arresting. In the case of one visitor, they could not even look away from the sculpture during the interview, commenting, 'It kept drawing us back… I'm looking at it now'. In summary, attention was sustained by an ephemeral and relational combination of aesthetics and affordances, which acted as more than a hook, creating a 'special moment' or 'atmosphere', which visitors experienced as an intensity of affect.

In summary, HAVING ATTENTION DRAWN was one of the processes through which visitors' WANDERING AROUND became structured, ordered, and paced, as they moved from exhibit to exhibit. Attention literally physically drew visitors through the space of the exhibition, towards visually striking and aesthetic aspects of the exhibition, as well as things which were perceived to offer desirable affordances. Attention was maintained by the relationality of multiple factors creating 'special moments' and 'atmospheres'. The next section describes FILTERING, the more active counterpart to HAVING ATTENTION DRAWN.

7.2.2 Filtering

FILTERING was the decision-making process by which visitors chose to (dis)engage with the exhibition. Visitors actively filtered the experience of the exhibition, deciding to what they would devote further attention. Note that FILTERING necessarily came after HAVING ATTENTION DRAWN, in that the drawing of attention reflected the affective and partially pre-cognitive sense of movement and attraction to certain areas of the exhibition, whereas filtering was the active process of distinguishing whether further investigation was merited in a more or less conscious calculation of effort versus reward. Hazel illustrated this process when talking about her thinking behind interacting with Small Invisible:

> *I was thinking about actually the information I was reading, and then thinking, 'well, how does this apply to the display around it?' And actually, 'what else could I do with regard to learning more about this?', or, 'do I want to learn more, or don't I want to learn more?' So,*

> *it was interesting to actually think, 'do I want to know more about that or not?' Again, it's how much you can learn in one little chunk of time, isn't it. (Hazel, 50-54, Teacher)*

FILTERING was necessary, as Hazel alluded, as a response to avoid information overload and to make sense of the exhibition by enabling the visitor to sort competing demands for attention. FILTERING structured the visit by defining what was relevant to attend to and what could be ignored.

Logically, FILTERING primarily presented itself as visitors rejecting engagement with certain aspects of the exhibition, which they found uninteresting or unappealing. For example, Anna, talking about the Infinity Blue sculpture said,

> *But the science of it was a bit over my head, to be honest. And I have to say, at my age, there're, I'm still interested in learning, but there are certain things when I think, 'Do I really need to know this? Can't be bothered. Move on'. I was impressed with it, but in depth it was too much. (Anna, 70+, Retired)*

In fact, Anna filtered out much of the exhibition, which she attributed to her 'phase of life', as reiterated when she mentioned Small Invisible:

> *Well, I'm at a different phase of life, so my, my desire to acquire information is different. And I was beginning to get information overload. And I wanted to move on. I mean, I know there's lots of strange bugs inside us and they do all different things, and that's as far as I want to go with it. I don't want to know the intimate details. So, I wanted to skip by.*

Despite Anna having some pre-existing awareness of microbiology, she actively chose not to engage in finding out more about it, deciding that the level of detail offered by the exhibition was too much for her. Joel and Sally felt similarly about most of the *Invisible Worlds* exhibition, but for different reasons. Unlike Anna, who attributed her disinterest to her age, the couple addressed the appeal of the unknowns of space rather than what Joel referred to as 'science stuff':

> ***Joel:*** *[Space] feels more like the unknown, whereas the science stuff is stuff that we know already. I don't personally know it, but you know, it doesn't hold as much...*
>
> ***Sally:*** *We've got questions here and know that there's answers.*
>
> *(Joel, 30-34, Designer, and Sally, 25-29, Nurse)*

In saying that space 'feels' unknown, Joel hinted towards an affective dimension of knowing and not knowing. While Sally described the temporary exhibition of astronomical photographs as 'captivating' and 'amazing', the couple showed little enthusiasm for the 'known' microbiological aspects of the exhibition. The experiences of Anna, Joel, and Sally showed that unappealing aspects of the exhibition were in many cases what could be called 'known unknowns'. That is topics which visitors were aware they did not know about, and had little interest in exploring further.

Nevertheless, whether something was filtered or not was not an intrinsic property of the subject matter itself. Hazel, for example, had a much different reaction to the topic of space than Joel and Sally above: 'Once I saw that the video display was about space I wasn't interested… As far as I'm concerned space is out there. It's nothing to do with me… And I moved on.' Unlike Joel and Sally, Hazel perceived space as a known unknown, which is 'out there', but had little relevance to her personally.

Beyond being in large part known unknowns, parts of the exhibition which visitors filtered were those where the perceived effort was high relative to the imagined reward of engaging. While Joel and Sally above were captivated by a temporary exhibition showing photographs of space, their reaction to the exhibits near the main entrance to the Core (Small, Vast, and Past Invisible) created an interesting comparison as can be seen from the following exchange:

> ***Joel:*** *I think with things like that, that are interactive […] you have to be interested because you obviously take part and you have to invest your time reading and looking and exploring – which I think is great for kids – but I think adults' attention spans are a lot shorter and you really are only interested in what you're interested in […] I just skip through things like that, things that require my energy because unless I'm really bothered, I'm not going to invest my time.*
>
> ***Sally:*** *So, we've got limited time this afternoon, I guess. In the back of your mind, you're thinking 'I'll see the things that I want to see,' […] in there, there was a lot of information to read and so you either invest your 20 minutes of reading... I don't think we would.*

While Joel and Sally were willing to spend time looking at the space photographs in detail, when it came to the interactive exhibits they became aware of the 'limited time' they had and Joel was aware of his short attention span. When the perceived 'energy' of interaction which Small, Past, and Vast Invisible required became onerous, the spending of time became, as Joel described, an investment calculated based on effort versus reward.

Visitors therefore also filtered the exhibition when the perceived 'reward' that an exhibit offered was not sufficient. Visitors expressed this as a feeling that questions the exhibition provoked would not be able to be answered by further exploration. Returning to Hazel, not only did she find the language used in the interpretation of Small Invisible required a great deal of effort to understand, but as she started to read, she realised she would not be able answer her questions by reading further:

> *But regarding all of the displays in the various little cabinets around the outside of the room, again the language that was given in the little spiels was very technical, very difficult and the, I found it difficult to relate the information to what I was seeing in the box. And I'm thinking, 'I feel inadequate here. This over my head.' I wanted to read it to see, to find out, but then I thought, 'No, this doesn't answer what I'm trying to find out.' Or I feel more confused now than I did before I read it.*

Despite a strong motivation to understand the exhibit, Hazel became disengaged with an accompanying feeling of inadequacy and confusion. Ed had a similar experience:

> *I wasn't sure just looking round whether if one spent a long, long time, if there would be answers to the questions or not. I mean, I could see that I couldn't be bothered to really find out because I feel as though if you just have a quick dabble you don't learn anything anyway […] I don't know whether by reading things more carefully whether it'd make you any the wiser or not […] That's why I switched off a little bit, because I think, 'Well I want to go and have a look at the plants now' […] I mean, looking at these, these things here, I don't even know… what they're trying to tell us. Do you? (Ed, 65-69, Retired)*

Ed's frustration led to him not engaging with the exhibition further. Again, both Hazel and Ed's experience brought the affective dimensions of knowing and not knowing to the fore. While as described above, known unknowns were in large part unappealing,

visitors also filtered depending on whether they perceived the exhibition to *afford* knowing and understanding. Unlike the rather more affectively neutral disinterest around known unknowns, FILTERING based on a perception that it was not *possible* to know constituted an unresolved feeling of curiosity, which for Hazel and Ed led to frustration, confusion, and ultimately disengagement.

Another reason for FILTERING was when the content of the exhibition was already familiar or otherwise 'self-explanatory'. For example, Ellie, talking about Small Invisible remarked, 'It's not necessarily my cup of tea because it's, it's a little bit closer to what I did for my degree, so I know a lot of it' (Ellie, 30-34, HR Administrator). Ellie chose not to engage with Small Invisible because her familiarity with the subject area meant that it did not offer a sense of novelty during a 'day out'. Similarly, Seth and Kimberly skipped over part of the exhibition because its message was superficially obvious to them:

> ***Seth:*** *I think I flicked through one, just to see if there was something behind it, but I think it was just that one, on the end, just seeing that it was that, but I certainly didn't do all of them.*
>
> ***Kimberly:*** *They were quite clear, the diagrams. You could look at them and see what the message was. It was self-explanatory, I thought.*
>
> *(Seth, 50-54, Healthcare Manager, and Kimberly, 55-59, Research Nurse)*

As such, they deemed that further exploration was unmerited, because they could comprehend the message of the exhibition without further engagement. In the language of affordances, in contrast to those who filtered because they perceived that the exhibition did not afford understanding *at all*, those who filtered due to over-familiarity instead perceived that deeper engagement with the exhibition would not afford *greater* understanding.

It is important to remember that WANDERING AROUND was a phenomenon, which was primarily experienced as embodied, and therefore was constrained *via* FILTERING by the limits of the physical body. As staff had noted, the Core building was often one of the final parts of a visitors' day out. Visitors were thus susceptible to fatigue, as articulated by Adam:

> *There's a lot of pictures and we already had a long day behind us, so we weren't like going through every single sentence… if you're just wandering through you don't feel all the text, I think… you don't have the endurance just to do it. And it's somewhat tiring I guess, to do it. (Adam, 30-34, Engineer)*

A long day seeing the rest of the Eden Project affected Adam's ability to focus his attention on the exhibition, which he perceived as 'tiring'. Similarly, overcrowding of the exhibition space led to FILTERING as a way to dispel uncomfortable feelings of intrusion and claustrophobia. Debbie remarked about *Invisible You*, 'It was too claustrophobic, I had to get out' (Debbie, 60-64, Housewife), while Kimberly noted about the Rock Garden,

> *You felt a bit almost intrusive for trying to look at all the different aspects… I'd be conscious of hovering by people that were sat out there trying to get a little bit of fresh air… So you were looking there and looking there as you went round, so I think if there was quite a few people, you could feel like you were holding everyone up a little bit, if you were having a look at each one. (Kimberly, 55-59, Research Nurse)*

As Adam, Debbie, and Kimberly showed, FILTERING extended beyond the possibilities of knowing/understanding and not knowing/understanding and was also the result of embodied interactions between time and physical space. Fatigue, confined physical space, and the uncomfortable proximity of other people repelled visitors through the exhibition space, limited their attention, and reduced the amount of time they were willing to comfortably spend in the exhibition.

At an extreme, visitors rationalised extensive filtering by making assessments about who the exhibition was for (and that it was not for them). Sally, for instance, made sense of her indifference towards *Invisible Worlds* by concluding it was primarily for kids: **'**You know, little interactive spinny things where I guess, I'm an adult, it's not that arty or science, so you've got a little spinny thing, I give it a spin, okay, move on, for me, to something else…' (Sally, 25-29, Nurse). By distancing herself as an 'adult' from the childish exhibition, Sally explained why rather than actively engaging with the exhibition, she instead found herself 'going through the motions'. Judith and her husband Ivan also distanced themselves from the exhibition because they felt that the Core was their 'least favourite' part of the Eden Project, calling it claustrophobic,

saying ‘ten minutes and I’d had enough’. While they had a lot to say about the topic of the exhibition, they unfortunately left *Invisible Worlds* feeling that they were stupid in some way:

> *I was going to say it's, as you can tell we're not academics. And it is probably is more for academic people… But Mr and Mrs Bloggs like us it's, it's probably too much information… This place is for everybody, not just for thickos like us. (Judith, 70+, Retired)*

While the couple appreciated that others may have enjoyed *Invisible Worlds*, they made sense of their FILTERING, and resultant unpleasant feelings by deducing that the exhibition was simply not for them. By dealing with the unpleasant affective response which constituted extensive FILTERING by distancing themselves from the exhibition, visitors re-defined their relative status – Sally as an ‘adult’, and Judith as a ‘thicko’.

FILTERING was at a surface level a calculation of effort versus reward, but that calculation was based on a complex interplay between dimensions such as knowing and not knowing, emotions, and physical comfort. While for some, FILTERING was a neutral process as part of sorting through competing demands for attention, for others extensive FILTERING was a result of confusion, disappointment, or physical discomfort, which at an extreme led to an assessment of the exhibition not being for them. While some visitors were able to maintain their status by determining the exhibition was for kids, others suffered a loss of status, which made them feel ‘inadequate’.

7.3 Trying to Understand

While drawing visitors’ attention and them actively filtering was important in shaping visitors’ experience in *Invisible Worlds*, merely having visitors’ attention was not sufficient to enable visitors to create deeper meaning. Patsy, for instance noted the use of disgust as an attentional hook in Invisible You, saying:

> *I just remember looking at that and thinking it was really gross.... But that was the only one where I had that kind of really superficial, ‘eugh bacteria, gross’... But that really... I can't even remember what it was.*

And then later,

> *Yeah. We were mostly commenting on the word sphincter… Yeah, I didn't get much else out of that one to be honest.*

And so, while the exhibits drew Patsy's attention, they failed to engage her beyond her initial reaction of disgust. By the time of the interview, immediately after the visit, she could hardly remember what it was, despite having had a relatively more poignant experience in other parts of the exhibition, which she was able to recall in detail. Furthermore, parts of the exhibition were simply nice to look at, and that was it, as Lewis noted, 'It just looked cool, it literally just looked very cool. I can't tell you what that was about' (Lewis, 20-24, Salesperson). These experiences showed that reactionary 'affective gimmicks' and aesthetic experiences were not enough, and that *wandering around* on its own did not explain how visitors engaged more deeply with the exhibition.

To that end, the primarily aesthetic and embodied process of *wandering around* interacted with a more cognitive sense-making process which Hazel described as 'trying to understand' when talking about the centrepiece sculpture Infinity Blue:

> *So, we were reading the exhibit about what this particular piece of sculpture was, and what it was doing, what it was about. And fascinated about the smells in the room because I'm very aware of smell. And we could see it producing the rings, which were fascinating. But the actual explanation of what it is, I must admit, we were a bit confused over […] We watched the video on the big screen, which was very interesting. I thought it was strange that it wasn't actually talked through. So, it was just a video presentation, rather than actually any language with it. Because obviously if I'm visually [impaired] then I can't see that video […] Equally, if I don't understand English, if English is not my first language, which it is, the display would mean nothing to me where it explains what this sculpture is about. (Hazel, 50-54, Teacher)*

In this excerpt, Hazel described several strategies she used to make sense of the exhibition. Firstly she questioned – What is it doing? What is it about? She then used the resources available in the exhibition to try and find out more information – reading, smelling, seeing, watching. Hazel found herself confused about what she was experiencing and drew on her internal resources by imagining what the exhibit must be like for a person with visual impairment or without English as a first language. By so doing, Hazel gained an understanding of Infinity Blue as something,

which ‘a lot of people they wouldn't even begin to understand what this is about’. While Hazel’s attempts at *Trying to Understand* were rather unsuccessful, leading her to a negative evaluation of Infinity Blue, the strategies she used to make sense of the exhibit were common across the interviewed visitors, described in the following sections (Figure 16).

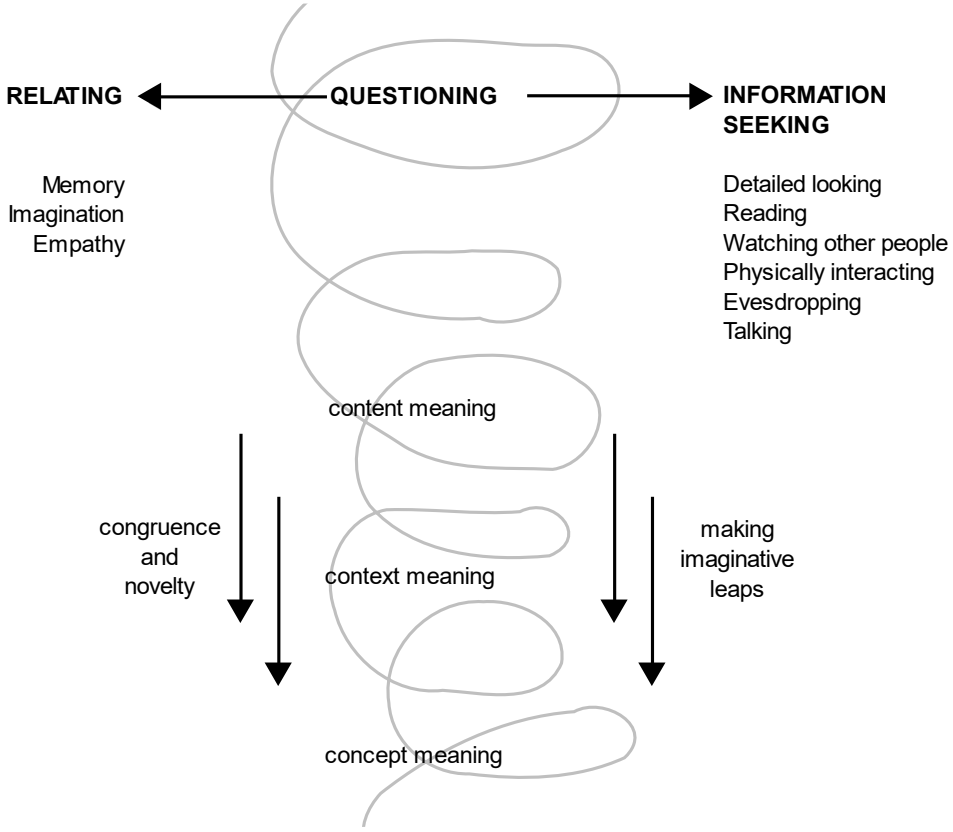


Figure 16 A conceptual diagram illustrating the relationships between the different processes of trying to understand. Through sequential questioning, information seeking and relating, visitors are able to make successively more abstract levels of meaning.

7.3.1 Questioning

QUESTIONING simply consisted of visitors asking questions of the exhibition, often initiated by focused attention and a feeling of curiosity, as illustrated by Tony:

> *We stopped at this art installation. Particularly eye-catching. Seed I think it was called… We didn't know what it was when we were walking in… And there's this massive granite sculpture… And the other thing is, I suppose, walking in there you’re like, ‘Ok, it's a big seed, big deal. What's the scientific side of that?’ (Tony, 25-29, Doctor)*

Tony's question acted as the beginning of a process, which allowed him to make sense of the sculpture.

Visitors' questions were rarely content-specific, but instead were much more open and conceptual in nature, asking, for example, 'What on earth is that?', 'Why? How?', 'what it depicted', 'Is it an interpretation?', 'Wondering what was going to come next'. Many of the questions participants posed of the exhibition were critical, asking how the immediate experience fitted in to the rest of the exhibition and the rest of Eden as a whole, whether the medium was appropriate, and questioning what the message of the exhibition actually was. Self-questioning was also common, around whether to keep going, whether they were actually getting anything out of the experience, and whether their own imaginations and responses to the content fell within the scope of the exhibition. Participants often questioned and sought information on how exhibits and artworks were made - 'how does this work?'. For example, Niall, talking about the Seed sculpture said, 'I was wondering how, how long it must have taken to carve it out and how much detail they must have put into it'. Finally, questions about affordances prompted exploration of what was possible or allowed in the exhibition space, asking, 'What else can I do?'

By asking questions, visitors were not just trying to understand the discursive content of the exhibition, but were trying to make sense of what had drawn their attention, further exploring the affordances offered by the exhibition, as well as relating to the makers' intentions and motivations. This QUESTIONING, prompted by initial embodied and affective responses to the exhibition, provoked further action in the form of INFORMATION-SEEKING to begin to answer those questions.

7.3.2 Information-seeking

INFORMATION-SEEKING describes how visitors tried to answer their questions about *Invisible Worlds* by investigating and drawing on the resources provided by the exhibition. Beyond the perception of affordances which may have initially drawn visitors' attention, INFORMATION-SEEKING was the way by which these affordances were tested and exploited by seeking sensory, material or symbolic feedback from the exhibition.

Vision was one of the primary ways by which visitors sought information. As explained above, looking was important for orienting visitors, getting a 'feel' for the space, and drawing attention. Further to this, close looking allowed visitors to focus their attention on the exhibits and understand the subject, materials and construction of artworks. The following exchange between Joel and Sally showed how close looking was afforded, by large-print photographs, in a temporary exhibition:

> ***Joel:*** *I thought that exhibition was great because they're things that you don't really get to see… where you can stop and stare at them.*
>
> ***Sally:*** *Yes, they've got small bits... its photo... whoa, drawing you in.*
>
> *(Joel, 30-34, UX Designer; Sally, 25-29, Nurse)*

As Sally and Joel explained, part of the attraction of the photos was their detail, allowing them the novelty of stopping and staring, seeing and appreciating details, which you might not normally notice. Rita, a 60-64-year-old retiree, explained this aspect of INFORMATION-SEEKING further when describing her attraction to the artworks and sculptures. Saying, 'I'm just a visual person really', she showed how visually appealing exhibits afforded the performance of an identity of being a 'visual person' interested in sculpture, through close, discerning looking.

Visitors also *watched* as an active form of looking, which allowed them to make sense of dynamic aspects of the exhibition, such as kinetic sculpture, audio-visual media, and other people. Sean illustrated this point when discussing Past Invisible:

> *And again, kind of a bit of a timescale of how our planet's changed, how the environment has changed. It was quite interesting, to the far left on some of the… things like a temperature gauge of how the temperature changed through everything that was happening in the video. And yeah, that was quite cool, that was quite interesting to see how that has been affected and fluctuated by life and how it's kind of grown. (Sean, 20-24, Outdoor Instructor)*

By watching the projected temperature gauge, Sean was able to gain an understanding of how the Earth's temperature had changed over time. Watching in this way was differentiated from just looking by attempts to discern patterns or difference over a period of time – as one visitor put it 'figuring out what was going on'.

There was also a social dimension to watching in that unlike looking which was a more solitary activity, when watching, visitors became one of many spectators, with Caitlin noting, for example, of Past Invisible, 'Actually, when we were there, there was [sic] quite a few people watching it, it was quite a busy little area' (Caitlin, 55-59 Sales Assistant). The social nature of watching was particularly noticeable with Infinity Blue, to the extent that one visitor commented that they felt 'everyone stopped' when it started to emit smoke rings. Kimberly and Seth further illustrated this point in the following exchange:

> ***Kimberly:*** *I suspect it's one of those where you could just sit and watch it for hours, watching the people as much as watching the installation itself.*
>
> ***Seth:*** *Kids got close, adults held back.*
>
> ***Kimberly:*** *There was a definite periphery for the adults and the children were getting closer and closer. I think, if they could have popped their hands in, they would have done.*
>
> *(Kimberly, 55-59, Research Nurse and Seth, 50-54, Healthcare Manager)*

By watching, Kimberly and Seth were able to identify what was possible and permissible, and for whom, as a spectator of Infinity Blue. As the couple hinted, watching was a source of enjoyment in itself, and created an excited feeling of shared experience, where in one case 'everyone was […] cheering and roaring'. Beyond the build-up of activity from the sculpture itself, Gary articulated how the transient social dimension of watching made each moment unique:

> *'It feels quite different as well, every time – you've got different people looking at it – that was maybe five minutes after we left, and you've got a whole new range of different people watching it and interacting with it, so it's going to be different every time.' (Gary, 20-24, Camera Operator)*

Gary showed therefore how watching, as a form of INFORMATION-SEEKING, was not just a means to an end to find out factual information, but that it was constitutive of the experience of being in the exhibition itself.

Other than vision, movement was also a prominent form of INFORMATION-SEEKING where exhibits afforded the possibility. For example, foot shaped pads on the floor at

the Vast Invisible suggested visitors stand in place and move their bodies to interact with the device, with a silhouette of their body appearing on the screen. Many visitors moved their bodies in wild, silly and unusual ways to test the limits of the technology in an attempt to discern the affordances of the exhibit, as illustrated by Theodore:

> *I kind of was trying to see how much, which parts of the shadow I could actually get moving. So, as well as its hands, I got its head its neck and the top of his body shaking around as well. Then I also learnt that it didn't do the legs, and the minute he took one foot off the pad actually it stops it working. So, must be something to do with connectivity of the two feet on the pad. It was very clever […] I just wanted to see how far I could push it, make it move. (Theodore, 65-69, Accountant)*

However, while the silhouette moved in response to visitors' movements, those movements had no consequential effect on the exhibit's display of nutrient cycles. Because of this, Vast Invisible was unable to respond to visitors attempts to understand, the result of which was articulated by Bill:

> *But you lost sort of focus. If you asked, if you're interested in if we know what the exhibition is about in that case, I couldn't tell you. So, I wouldn't quite know what they were, what it was meant to teach me. I just, it was more fun to interact with it, in that case. (Bill, 70+, Arbitrator)*

The mismatch between the promise of an affordance which was not met with adequate feedback led to protracted INFORMATION-SEEKING, whereby testing the limits of the technology became the focus, rather than attempts at making sense of Vast Invisible within the context of the exhibition.

In contrast to other forms of INFORMATION-SEEKING, few visitors discussed reading the exhibits' interpretation in detail, and many visitors proclaimed that they had not read much of the text in the exhibition at all. When they did mention reading, much as when visitors were 'just' wandering, they were also 'just' reading. This omission to an extent is telling of the difference between reading and other modes of INFORMATION-SEEKING, in that reading was commonly perceived as a mundane way of obtaining factual 'information', or as one visitor put it – 'the science', after other ways of INFORMATION-SEEKING had been exhausted. Reading seemed to be perceived as effortful, relative to other modes of INFORMATION-SEEKING, with a higher bar of HAVING

ATTENTION DRAWN than perhaps looking, watching, moving etc. Charles illustrated this by qualifying his desire to read, saying, 'If something caught my attention enough to read it, yeah. I am a reader anyhow […] So, if something visually pulled me in and then I'd read... "oh, what's this about?"' In this short quote, Charles reinforced the sequence of events from HAVING ATTENTION DRAWN, to QUESTIONING, and INFORMATION-SEEKING, and also re-iterated how visitors performed their identities through INFORMATION-SEEKING. In Charles' case he defined himself as a 'reader'. The construction of identity through Information-seeking was further explicated by the following exchange from Sally and Joel:

> ***Sally:*** *We didn't stop to read a lot.*
>
> ***Joel:*** *We're not readers, are we.*
>
> ***Sally:*** *Well, not of micro-organisms and bacteria and things.*
>
> ***Joel:*** *It depends what it is, really.*
>
> *(Sally, 25-29, Nurse and Joel, 30-34 UX Designer)*

In contrast to Charles who identified himself as a 'reader', Sally and Joel identified themselves as 'not readers'. However, this identification was contingent – 'it depends', indicating that rather than drawing on fixed and pre-determined identities, visitors actively constructed their identities in relation to *Invisible Worlds*, becoming 'readers' and 'not readers' as they interacted with the exhibition (cf. 'adults' and 'thickos' above).

While visitors' INFORMATION-SEEKING in *Invisible Worlds* was primarily visual and kinaesthetic, some visitors also used touch, sound, and even smell to gain an understanding of the exhibition. Overall, INFORMATION-SEEKING was a sensory and embodied way of TRYING TO UNDERSTAND*,* which provided not just information about facts, but also about affordances, possibilities, and embodied understandings. Visitors' experiences showed how different forms of INFORMATION-SEEKING allowed visitors to both perform and construct their identities in relation to the exhibition, and that rather than being simply a means to an end which added informational context or meaning to the experience, INFORMATION-SEEKING as an active, embodied, and social process was constitutive of the experience itself.

7.3.3 Relating

RELATING refers to the strategies visitors used to draw on their internal resources of memory and imagination, 'making your imagination go to that other point' (Jacob, 55-59, Tutor). To answer their QUESTIONING, visitors creatively drew on a wide range of knowledge and experience, relating their present experience to ideas, memories and imaginations. By so doing, visitors actively made connections and comparisons, which allowed visitors to understand the exhibition in a variety of ways. Paige, for example, enjoyed watching the reactions of children playing with Infinity Blue:

> *I just looked at it… The circles of smoke coming out and the reactions of the children particularly as they saw them, chasing them, and catching them, which is what our grandchildren would be doing if they were here. (Paige, 60-64, Business Manager)*

For Paige, watching the children play was an enjoyable thing to do in itself. She further perceived the imagined affordances which the sculpture would offer her own grandchildren, and so the sculpture also afforded reflection and reminiscence on her identity as a grandmother. In general, relating consisted of '[applying] it to your life and what's going on around you' (Evie, 20-24, Ranger), positioning the present experience of being in *Invisible Worlds*, within a relational network of understanding.

The relational connections, which visitors made, could be loosely sorted into four main categories:

Self - Visitors related the exhibition to their sense of self in a variety of ways. Focusing on the content or medium of the exhibition, visitors commonly related to a work identity. Brian (55-59, Coach Driver), for example, stated, 'I used to be an engineer before I was a coach driver, so, you know, things like that you do look at and think, you know, somebody has put some work into that.' Visitors performed their identities by drawing on prior experience and knowledge to make sense of the exhibition. In some cases, visitors created an imagined self, allowing them to place themselves in a different time or place, or see the exhibition in a different way than their actual selves. Anna (70+, Retired) imagined an alternative life where she might have been an engineer, 'But I'm interested in the architecture and the engineering of

this entire structure. It's fascinating. I should have been an engineer.' Rosa took a more imaginative approach, placing herself within the microscopic world:

> *I was thinking about being a tiny, tiny, tiny, little person because this thing that's normally like absolutely invisible is suddenly massive. And it makes you think about the micro world more, doesn't it, and how much stuff is constantly going on that you never see. (Rosa, 35-39, Social Worker)*

Visitors also related the content of the exhibition to their behaviour, particularly around recycling and diet. Relating the exhibition to the self allowed visitors to place the unfamiliar of the exhibition within a familiar frame and to perform both real and imagined identities.

Other - Visitors also related to other people either present in the exhibition or not, referring to other visitors' behaviour, or to other people and norms, saying what people should do. Often this talk emphasised the social good of learning and finding out about 'these kinds of things'.

Visitors referred to other people in the exhibition, commenting on their behaviour, sometimes in great detail, such as Hazel, who relayed an extended anecdote about watching a family interact with an exhibit in the Invisible You part of the exhibition. For Hazel, watching others was an important part of the experience, which allowed her to make sense of the exhibition by drawing on her identity as a teacher. In some cases, watching other people interacting with the exhibition, or the content of the exhibition itself prompted visitors to relate to other people in general, outside of the context of the exhibition. By so doing, visitors constructed a 'generalised other', against which they could frame their decision to visit the Eden Project as the right thing to do as an engaged citizen. Those who had a less positive experience of *Invisible Worlds* similarly drew relations to 'generalised others', often referring to those who may enjoy or benefit from the exhibition most.

A third way in which visitors related to other people was by relating to the artists who had created the artworks in the exhibition. Visitors empathised with the artists, commenting on the personal attributes, which they must have, such as skill, patience, passion, and determination.

Discourse - Visitors drew on a range of discourses which helped them to make sense of the exhibition. Most of these discourses fell into what could be called 'then and now' discourses which compared the present with the past and discussed scientific progress (or lack thereof), and its impacts on everyday life. In particular, visitors compared a sterile and unhealthy present to a dirty but wholesome past. For example, Debbie (60-64, Housewife) noted, 'Actually the problem with kids today is that it's too sterile… Parents are keeping everything too clean… Because that's the only thing different to when we were growing up. Those sprays didn't exist… And we didn't have all the problems.' Drawing on these discourses, along with admonishing present-day fussy parents, enabled some visitors to enact parent and grandparent identities. For some visitors, the 'then and now' discourse was projected into the future, instead talking about future generations and expressing concern about the kind of world that would be left for their children or grandchildren.

Some visitors drew on broader discourses around, for instance, anti-microbial resistance, plastics and recycling, and human nature in general. I don't make any attempt to comprehensively map these discourses, only to say that discourses were just one among a range of resources which visitors made use of when trying to understand.

Rest of Eden - Other than relating the experience of *Invisible Worlds* to themselves, other people, or wider discourses around the topic of the exhibition, visitors also critically related their experience to the rest of the Eden Project as a whole. Relating to the rest of Eden reflected attempts to situate their experience within the wider context of the day out to discern a broader, overall meaning.

Overall, visitors who were successful at relating their present experience to a wide range of internal resources felt a sense of reminding or reinforcement, of putting together disparate information in a new way, as Jacob articulated,

> *It's a concept that we'll probably know… we'll think we know what bacterias [sic] and these things are, but you just… you can't paint it yourself or take a picture of it… but it was just, it was putting it all together… Probably when you get to our age you've heard most of it, you've learnt most of it at school and you continue learning*

> *afterwards. And then the papers start filling you full of other rubbish. And then you pick up a journal in a doctor's surgery or a dentist surgery and you read other things about it, you know. And you're always gaining that information but not being able to pack it out the way that that did, in a fashion. It was painting a picture that you were getting, that you've got in your brain. (Jacob, 55-59, Tutor)*

This reinforcement created new conceptual understandings, which situated the experience in *Invisible Worlds* within a wider context. For visitors who successfully managed to relate, they gained a sense of the exhibition being congruent to their lives, as if the exhibition were speaking directly to them, as the following exchange shows,

> ***Ben:*** *…some of these were very, very poignant.*
>
> ***Sophia:*** *Oh my god. They were really, really good. About your life, weren't they.*

7.3.4 Congruence and Making Imaginative Leaps

As visitors went around *Invisible Worlds*, QUESTIONING its contents, RELATING it to memories and ideas, and seeking information, visitors made imaginative leaps which took them beyond the immediate content of the exhibition. For example, in the following extract of Jacob talking about Infinity Blue, she relates it to a volcanic eruption in Guatemala. Making the connection between the sculpture and the volcano on one hand takes an imaginative leap, but she stretches this further, reflecting on 'where the world is',

> *It's mesmerising, isn't it. It's just like, just, 'Why has that happened?'. And I suppose that's where the world is. It just goes along and then it like, well... obviously you've got that, you've got that volcano in Guatemala or wherever just sitting there for hundreds of years, and then thinks, 'Ah, today I'm going to go bang, poof'… And that's the same concept. (Jacob, 55-59, Tutor)*

Visitors who were able to strongly relate to the exhibition in a variety of ways felt a sense of congruence between the exhibition and their own views. These visitors had a sense of the exhibition reminding or reinforcing pre-existing views, or of the exhibition putting together previously disparate prior knowledge and understandings in new ways, creating a new conceptual understanding. Visitors did this by making imaginative leaps to connect disparate areas of relation through successively more

abstract ways of understanding. By making these leaps, visitors were able to deepen the meaning the exhibition had for them, from meaning focused around the content of the exhibition, to its wider context, and finally to a broader conceptual meaning. For example, Hazel described a photo she took of the ceiling of the exhibition,

> *'And see how they've made a building in lots of different materials, with lots of different angles and different sizes, and actually how they've made it lit without lights. So, the refraction of the light with the, the bubbly metal panels from the triangles in the ceiling, and obviously it's a stunning building from the outside as well. It's really attractive, and it would be a real talking point to young children as well as older children. So, it's not just a building, it's built like this for a reason. And there is always a reason behind everything that is designed in the way that it is.' (Hazel, 50-54, Teacher)*

First, Hazel focused on the immediate reality of the exhibition, the material properties of the ceiling, which caught her attention. Next, she made an imaginative leap, going from the immediate context of the exhibition to imagine how children (remembering that Hazel is a teacher) might respond to looking at the ceiling in the way she did. A final imaginative leap takes Hazel's understanding to a more abstract, conceptual level – 'there is always a reason behind everything that is designed.'

Similarly, Patsy described her experience of one of the exhibits in Invisible You,

> *'It's funny, it looks more yucky in the picture actually than it does in real life, possibly because the colours are more varied when you actually see it. I didn't find it, I didn't find it yuck, which... If you imagine it actually being in your face, it's quite gross. But I just found it really interesting. Again, there's this world going on around, on us all the time. And I've been brewing kombucha recently so, I'm quite interested in microbes. And I read some research about, you know, you can give two people the same kombucha starter and then they brew it, even in kitchens like next door to each other, and just because of whatever microbes they had on their hands or whatever when they prepared it, the kombucha will come out tasting really different. And so, I found that quite interesting that we, we all have these, you know, ecosystems, unique ecosystems going on all the time.' (Patsy, 35-39, Teacher)*

First, Patsy responds to her initial reaction to the exhibit, contrasting her interest with disgust. She then makes an imaginative leap by relating the artwork to her interest in kombucha, a fermented drink. And finally, Patsy makes a further conceptual leap

from the relation between the exhibit and kombucha – we have 'unique ecosystems', or in other words, Patsy conceptualises the human biome.

In both cases, Hazel and Patsy reached deeper, more conceptual, and abstract levels of understanding by making imaginative leaps based on relating the exhibit to internal resources. Neither, however, gave any indication that the understandings generated are new, or previously unknown. Instead, as mentioned in the previous section, we can infer a reinforcement of existing understandings, which Patsy articulated when describing a photograph she took of an interpretation panel,

> *'Having seen the animation just a few minutes before, that was just another kind of reinforcement of that huge journey and passage of time and how things developed. And a reminder of where we came from, which is so far away from where we consider ourselves to be now, you know. And it's quite humbling really. And I mean in a good way it's humbling…'*

And later talking about Eden as a whole,

> *'Yeah, and I suppose it, it reinforces, in that sense, thoughts that you already have'*

While some visitors grasped the overall concept of the exhibition, it still left them feeling otherwise uninspired. Based on visitors' descriptions of their more meaningful experiences, it was necessary not just to comprehend the concept of the exhibition, but to pass through successively abstract levels of meaning through RELATING and MAKING IMAGINATIVE LEAPS. Creating deeper meaning therefore relied on the ability of the visitor to embed the exhibition experience within a converging network of relations.

7.4 Integrating into a Life Story

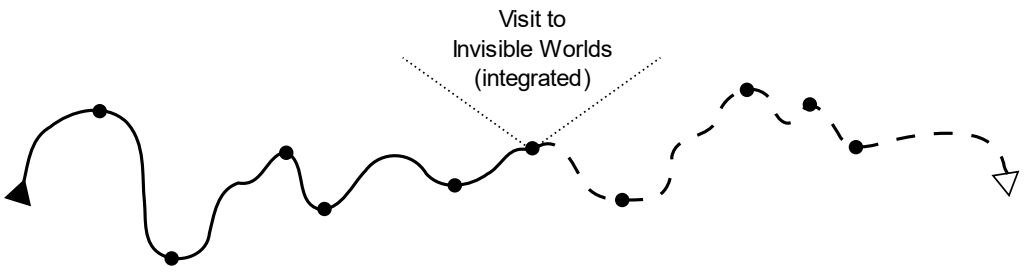
Thus far, this chapter has presented the process of SERENDIPITOUS WANDERING during a visit to *Invisible Worlds*. INTEGRATING INTO A LIFE STORY describes how the process continued after the visit, to become more deeply meaningful, contributing to something which might be considered transformational. This section draws on the follow-up interviews with visitors, which reflect the experiences of a subset of those interviewed for the present study. As such, while this section presents assertions

which may be interesting starting points for future study, they represent a narrower range of experience and should be interpreted accordingly.

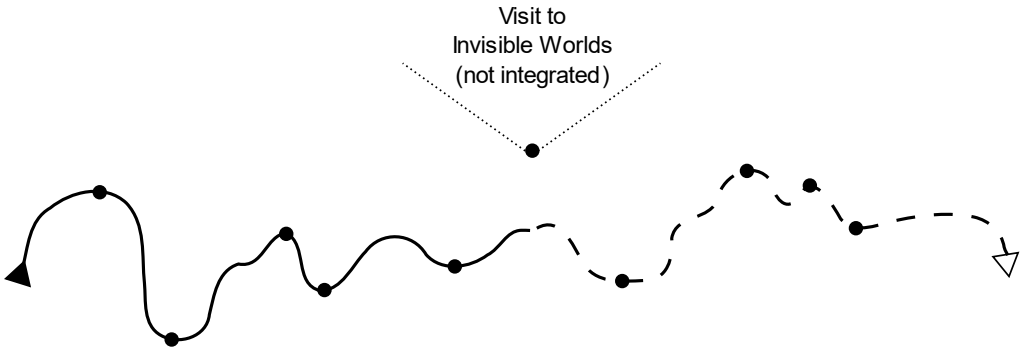
Those visitors who identified themselves as having had a deeply meaningful experience in *Invisible Worlds* were able to integrate their experience and conceptual understanding into an unresolved narrativised life story (Figure 17). By life story, I mean the kinds of stories which we might tell about our lives, with a beginning, a middle, and an end, rather than the life-course as a whole. It is the selection and ordering of life events into a coherent narrative about the self (or identity) over time. An unresolved story, as illustrated below, represents a life story which, as yet, has no ending, making it amenable to having new events integrated within it.

To make sense of this idea, I present three examples. Firstly, Pippa related her experience to an ongoing commitment to develop a closer connection to the natural world, and the visit was integrated as part of that ongoing life story (Figure 17: A). Secondly, Samuel, had a valuable experience, but it was not integrated into a life story and remained as a nice ‘day out’ (Figure 17: B). Finally, Jade had a nice time in the exhibition which related to her deep interest in science, however her ‘life story’ around developing an interest in science was resolved and as such the visit was not integrated, remaining as a nice ‘day out’ (Figure 17: C).

A: Visit to Invisible Worlds is integrated into an ongoing "life story"



B: Visit to Invisible Worlds is not integrated into an ongoing "life story"



C: Visit to Invisible Worlds is not integrated into a completed "life story"

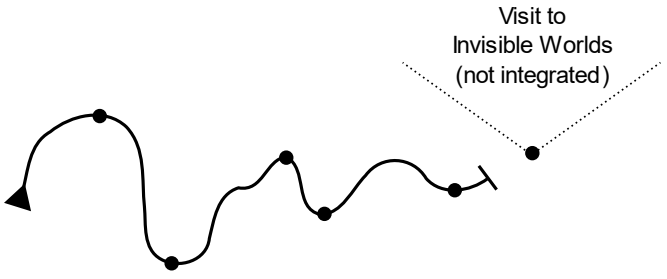


Figure 17 A conceptual diagram illustrating integrating into a life story. A deeply meaningful or transformative experience is integrated into an as yet unresolved story about the visitor's life.

7.4.1 Pippa: Integrating into an unresolved life story

Pippa had travelled from Australia in June 2018 to visit a friend who had recently had a baby. She and her friend Sally share a strong connection to the natural world, so they took the opportunity to visit the Eden Project together while they were in the area. Pippa, in her late thirties, is a Steiner school teacher, and has had a strong connection with nature and animals her whole life. Pippa described the development of her connection with the natural world as follows:

> *I think now, particularly since moving to Australia where it's, as I said, it's so easy to get to really wild places so quickly. You know, I mean I live in the suburbs, but I can, it's still like, it's not like an English suburb, you know, more like the countryside. And you can get to real, real, you know, bush very quickly. And that's kind of reignited it I think, just because I have access to it. So, I guess that's the kind of progression. And I also, I'm a teacher. I worked in mainstream until moving to Australia. I now work in Steiner education. And that really kind of emphasises connection to nature as well. So, that's just kind of reinforced it for me.*

Like Samuel's story of being an engaged traveler later in the next section, Pippa could see her connection to nature developing in future, and described how she wanted to buy a rural property in Australia to be in nature all the time:

> *And I want to buy, I want to buy a big property with a lot of land, which again, I'm very fortunate because you can do that here. I mean, you know, getting a property with ten acres, a hundred acres, whatever, easy. So, yeah, that's what I want to do. And then it'll, it will be not just somewhere I go to. It will be where I live, where I exist every day. And, you know, if I, if I have ten acres it's not like I'm planning to kind of farm it or anything. That would be somewhere that could stay quite wild. And just be natural and just be there. So, that's my kind of very practical plan that I just feel so grateful that that is something I... that is an achievable goal, you know.*

Contrasting the other visitor stories which follow, Pippa did feel that her visit was more deeply meaningful. During the visit, she had a strong sense of her connection with the natural world being reinforced. Within the *Invisible Worlds*, she was able to relate to many aspects of the exhibition on a conceptual level. As such, Pippa was able to integrate her visit into her story of her developing connection with nature. It is

here where we see what might be called transformation. While the visit was not an inciting incident, Pippa used her experience to support an existing life journey.

7.4.2 Samuel: Not integrating into an ongoing life story

Samuel, a company director in his fifties, visited the Eden Project in June 2019 with his wife, Claire, completely by chance. They had been sailing to the Scilly Isles when bad weather meant they had to detour to Cornwall. They said they had always wanted to visit the Eden Project, but it was too far to travel.

When describing his visit during the follow-up interview, Samuel identified himself as an 'engaged traveler', and related his enjoyment of the Eden Project overall to this identity, and Eden being somewhere you can have a 'world tour in a day' and learn about other places, performing the identity of an engaged traveler without going anywhere. Samuel described how this identity had developed over time, primarily as a result of international travel for work,

> *I travel a lot with work but we also travel privately for holidays as well. You know, I mean, I'm interested in the places I go to. I don't just literally walk into the [tourist information] office and out again. We've travelled. We've done some walking tours in India. We've been to South Africa, been to Singapore, Japan, China… So, I think it's as a family we're interested in exploring different ideas and different ways of doing things and different lifestyles.*
>
> *[…]*
>
> *I think as I get older, I think as we get older we get more interested in other ways of life actually. You know, I'm more interested in the way other people do things, the way other cultures do things than perhaps I would have been ten years ago… So yeah, that's what we try and do each year, try and pick somewhere where we haven't been before that's a bit different, that's going to challenge us a little bit.*

Samuel further explained how his children becoming older allowed him to indulge more in being an engaged traveler and how he hoped in future, when he retired, he would have even more time to develop this identity.

While it is clear that Samuel had an enjoyable experience both in *Invisible Worlds* and at the Eden Project generally, this experience remained unintegrated with an

ongoing life story. Even though Samuel made a connection between his development as an engaged traveler, visiting the Eden Project did not become part of that story. When probing Samuel further in the follow up interview, he described his feelings as follows:

> *I think there's a danger of making too strong linkages between what is, first and foremost a very enjoyable day out that brings some issues to your attention… That's probably a bit of an over-stretch to say there's a very strong link between those. Yeah, does a facility like the Eden Project serve to raise awareness of issues, and bring other things that people couldn't see, other experiences, other lifestyles, other habitats to the people who couldn't ever go and see them? Absolutely. That's what is does brilliantly. And also a bit more of an in-depth understanding of how things are interconnected and therefore where we sit in that. Those things I think do... are supported by what the Eden Project brings to the table*
>
> *[…]*
>
> *And I think my view's probably shifted a bit. Having been there is just showing where we as humans sit in the chain, where our impacts are. Understanding how we can affect things. It brings it home. I know there were some people there, who were almost a religious experience, [we] use that word too lightly, but, you know, for some people it is almost a religious experience and I think pilgrimage is the right word. I wouldn't put myself in that category, but I wouldn't put myself into the unaffected, get myself ready, go and get myself a burger and chips and a wander round for an hour either.*

From this excerpt, we see that Samuel did have an experience that 'shifted' his view a bit. Nevertheless, he strongly warns against reading too much into it, and as such I argue that we cannot consider his experience to have been transformative. While he considered visiting the Eden Project a valuable learning experience, he did not see it as part of his ongoing development of becoming an 'engaged traveller' – the meaning of visiting the Eden Project, for Samuel, remained more down-to-earth, as 'a very enjoyable day out.'

7.4.3 Jade: Not integrating into a completed life story

Jade visited the Eden Project in May 2018 with her sister and brother-in-law. She is a 52-year-old school science technician and her interest in science came across during the initial interview. Jade described how she 'fell in' to science by chance,

when, after failing to find a job as a nursery nurse, a part-time job in a scientific company led to a new career opportunity,

> *It was really funny because when I left school I... I wouldn't say I wasn't interested in science, but I wasn't going to go along a science career path, but... I, I actually trained as a nursery nurse when I left school but then I got a casual job working for the Ministry of Agriculture in the laboratories there. So, I did a few months there and I enjoyed it so much that I got a full-time job there. And then… I got a job as quality control in [a] factory. And that was using my science. A lot of quality control testing, looking at microorganisms in all the different places of the factory, quite a lot of microscope work. And then I think I left that job because I had children, things like that. And I went back into science work. Because I became a science technician in a school local to me here in Gloucestershire. And I've been there for twenty-five years, actually. And it's just because I'm just so interested. Because it's, it's sort of multi-discipline really. And I'm senior technician now, so I look after all the other ones. And I've done, I did a open university course, a degree. And it was, it was an open degree, so I could more or less choose the disciplines I wanted to do. And I really enjoyed doing that. But it sort of, sort of progressed not really sort of meaning to do it, just, just, you know, I've just enjoyed it so much.*

As she described, Jade's early experiences resulted in a new career direction and many years of developing interest and further education. With that said, Jade's story has a different quality to Samuel's above in that it is complete – it has a well-defined beginning, middle and end. Jade went from not being that interested in a science career to being a senior science technician.

When asked about whether she might develop her interest in future, Jade replied,

> *I'm not sure that I'm going to... I think just my own personal reading, really, my own personal keeping up with things… I don't think, I'm not sure that I will progress myself in sort of my career any more now, but it'd just be my own personal knowledge I suppose. I think that's the only, only way I'll sort of progress now. And sort of my knowledge to the kids at school that I, I work with, so yeah.*

From her words, we see that Jade does not have much intention of developing her interest in science any further. While she might do some reading for personal interest, becoming a science person is no longer a journey which Jade is travelling

through. We can compare this to Samuel, who clearly saw himself developing into the identity of an 'engaged traveler' in future.

In any case, Jade did recognize the relevance of *Invisible Worlds* to her interests, and, like Samuel, had a very enjoyable experience. She related the exhibition to her interests as follows,

> *'Just because the whole environment, a lot of it is science related, isn't it. You know, the different areas of science the, you know, the Earth, you know, the different, different things in the atmosphere, you know, relating that to the environment and the atmosphere and weather patterns. Relating that to environment. It's all got a science background, hasn't it, you know, different biomes, they're all related to science in some way, I think, yeah.*

Nevertheless, Jade's description remains superficial – related to the content of the exhibition, rather than any deeper or more significant meaning. I argue that a possible explanation for Jade not having a more deeply meaningful (or transformative) experience in *Invisible Worlds* is that her life story of becoming a science person is complete. As such, she is unable to integrate her experience into an ongoing life story and the meaning of her visit remains as a 'day out'.

7.5 Chapter Summary

Visitors' experience in the *Invisible Worlds* exhibition was shaped by a relational and contingent process of 'serendipitous wandering'. The emphasis on 'wandering' foregrounds the embodied nature of visitors' experience, evoking and drawing on ideas of extended and embodied cognition to see visitors' efforts of trying to understand as fundamentally embodied. That is not to remove the importance of cognition in visitors' understandings, but to remove a false mind/body dualism to understand visitors' embodied interaction in the exhibition space. In particular, the results of the visitor study show how the relation between vision and movement guide attention.

Information-seeking was the process by which visitors sought answers to their questions but reading textual information was just one of the ways in which visitors sought information about the exhibition. Moving, close looking, watching, watching

other people, and touching all featured as important ways in which visitors sought to make sense of the exhibition. In some cases, visitors created deeper meaning my making successive relations and conceptual leaps.

Those visitors who identified their experience in *Invisible Worlds* as deeply meaningful were able to integrate their visit into an ongoing life story. Visitors who did this were able to draw on a range of practices to make sense of the exhibition. They had a sense of the exhibition bringing information they already knew together in new ways, making pre-existing ideas more coherent, or having a sense of reminding, reinforcing and reinvigorating. Integrating into a life story means that they could identify and integrate their experience in the exhibition with an ongoing life change.

8 Discussion: Serendipitous Wandering in the context of Negotiated Ambition

This chapter synthesises the two strands of work presented in this thesis, interpreting and situating the results within the wider literature. As is typical in grounded theory research, the end point is not the same place where the research started – new concepts, such as institutional maintenance work and affordances are introduced to situate ideas which developed throughout the course of analysis. Rather than being presented as a separate literature review, these ideas are woven throughout the discussion as they become relevant.

8.1 Project natural history

The results as presented thus far represent an end-point of the research journey – the product of what I learned along the way. But as the research project progressed, there were, as in any project, challenges and unexpected developments which might otherwise be excluded in a conventional description of research. These challenges throw the researcher's role and subjectivity into relief, as practical constraints butt up against paradigmatic ideals. As part of a commitment to reflexivity, in this section, I trace back the path which has led to the end point presented so far. I follow David Silverman's suggestion of a research "natural history" (2021), which shows the process, dead-ends and developments of research. Doing this is not to be indulgently self-referential, but to provide enough information heading into the discussion that the reader of this thesis might be satisfied that I have been self-critical in my work and to reflect on what my own experience may say about wider issues surrounding science communication research and practice.

Starting with the beginning of the project, as mentioned in previous chapters, I went in not knowing the Eden Project team, but nevertheless being familiar with and opinionated about the work of science centres, with a strong drive to improve science communication practice. I wanted to quickly build rapport with the team and buy-in for the research so that the PhD research could have a real impact both at the Eden Project and more widely. The first challenge I faced was in negotiating the

interface between the often rigid and bureaucratic nature of academia and the flexible and spontaneous ways of working at the Eden Project. In the first few meetings with the Eden Project, I tried to get a quick impression of the workings of the exhibition team which from an outside perspective might at first seem chaotic. To "manage" this situation I tried to impose structure through the relatively rigid methods of a Delphi process and repertory grid interviews (also in part motivated by the need to present a coherent research plan and obtain ethical approval). I felt that these methods would be efficient in collecting data, not taking too much time from the team, while clearly delimiting what would be required from participants. While providing useful information, these methods never felt like a good "fit" for the Eden Project. I ended up with what I perceived to be fairly un-enthusiastic participation and a disconnect between the research and Eden's practice.

As the project continued, I began to experiment with other methods. Opportunistic interviews captured ideas in the moment as and when participants were available. Reflective group discussion meetings resonated with the discussion and consensual working practices of regular team meetings. These methods felt like a better fit for the Eden Project team and, as I later began to appreciate, their creative, responsive and spontaneous modes of practice in response to practical and operational requirements. That is not to say that the initial methods were not useful, but that as the project progressed, I adapted the research methods I was using to better reflect the team's way of working. Reflection on the success and challenges of methods provided vital insight into how *Invisible Worlds* worked in ways which were informative to the analysis. Connecting research and practice became not just about working alongside one another, but appreciating that reflection on how research is changed through working with practice can be instructive in itself.

Another challenge to the project came in the form of the timescales and priorities involved in project-based working. It is perhaps a cliché to mention the relatively slow pace of academia versus the rapid nature of practice, which, as a backdrop, did provide one area of challenge. What is more interesting is how time and priorities shifted throughout the course of both projects in ways which sometimes aligned and sometimes clashed. While the PhD began with much excitement, the long process of

planning and ethical approval resulted in somewhat of a 'false start'. In the world of practice, it makes no sense why one would have to wait weeks or even months to start doing something – it can come across as overly cautious, fussy and bureaucratic (anathema to Eden). In any case, *Invisible Worlds* was already well underway and forging ahead, with or without me. But following a slow start, research speeds up. Once ethical approval was granted, the priority for me became generating as much data as possible in the timeframe available for the PhD, before *Invisible Worlds* opened. Here, *Invisible Worlds* was rushing towards the latter, more frenetic stages. Research was, understandably, seldom a priority amongst the practical challenges of getting the work done for the exhibition launch. From my personal perspective, this was a source of tension and frustration, which is where the contrasts between research and practice came to the fore. It was at the time where I had anticipated the most intensive period of working with the team, which was also the time when research was the lowest priority. It became hard to see where the *action* of action research might come from.

Contrastingly, after the launch of the exhibition, the research received a reprieve. There was a sudden increase in interest from the team as they worked towards addressing teething issues with the exhibition and were keen to demonstrate the success of the project. Equally, this period provided a window for reflection – in the reflective discussion meetings, emotions and challenges were openly discussed in a way which wasn't present while the production work was underway. It is for this reason that I have called the methodology used in this thesis 'grounded reflection'. Research data provided a grounding for reflection which led to a deeper understanding of both practice and visitor experience. It was here, towards the end of the project, where I started to reflect on what the action of the action research had been. While there had certainly been plenty of activity in the creation of the exhibition, its connection to the research was not clear; had there been any "action" at all?

It was reflecting on this issue, where a paradoxical slowness of practice became apparent. As my analysis had shown, while the team's ways of working were flexible, responsive and strategic, they were oriented towards maintaining existing practices. I

had learned that much of this effort was to keep the project going, to enable the exhibition development work to happen as the launch deadline hurtled closer. Learning, and change, was to happen on a much slower timescale, in the short pauses for breath between projects. Nevertheless, this period of reflection and pause was brief. Soon enough, staff moved on to new projects and the *Invisible Worlds* team dissolved. Individuals may take their own reflections and learning into future projects. Perhaps this is appropriate, in that this thesis has always taken a micro-social view, appreciating that organisational processes are made up of the product of individual actions and interactions. In any case, a question remains about the degree of learning from *Invisible Worlds* at an organisational level. In many ways, responsibility for wider learning falls to the present research as a way of capturing what happened in a way which may have a life beyond the individuals of the project. Equally, with the dissolution of the project team and the long and slow process of writing up the thesis – for whom is the research now? There are no easy answers to these considerations and addressing them comprehensively is far beyond the scope of this thesis, but I raise them here to highlight how the apparently straightforward *action* in action research was rendered indeterminate and problematic through the interface between research and practice.

Another issue to bear in mind is that the PhD was in part funded by the Eden Project. This situation was necessarily a trade-off. *Invisible Worlds* offered an unusual level of access to the exhibition development process which is rarely afforded to researchers, which allowed for deep understanding of science communication practice of a major multi-year project. But, at the same time, as a funder, there may be a conflict of interest in representing the Eden Project in a certain light. In general, I have attempted to represent *Invisible Worlds* fairly, highlighting what could be seen as both positives and negatives, whilst being careful to not make any value judgements about the team, their practice, or the success or otherwise of the exhibition itself – emphatically, this is not an evaluation.

With that said, the account presented in the thesis is necessarily selective, but the selectivity is perhaps more due to ethical, rather than financial, considerations. Selectivity is something I have grappled with throughout the PhD, treading carefully

to not slip into bias. As with any research, the participants were free to disclose or withhold any information as they saw fit, for example some discussions during meetings were off limits (even in a questionnaire or interview study, participants may omit or change information – objectivity or universal truths are not the aim here). In constructivist research, it is often alluded that the researcher and participants construct an understanding collaboratively with one another. As I found with action research, participants have even more of a hand in that collaboration. In contrast to the fairly straight-forward visitor research, I found that with the closer collaboration with the Eden team, that collaboration did not just happen during well-defined data collection periods but was continuous. The results presented in this thesis reflect on how the participants chose to represent themselves. Being explicit about this selectivity is why I chose to devote so much attention to methodology – the principles of *usefulness* and *practice orientation* underscore a methodological rationale for *Invisible Worlds* being reflected in a way which is useful to the exhibition team. What could have, if left unexamined, been a weakness or source of bias, became a strength of the approach. At the same time, my analysis has attempted to create concepts which are sufficiently theoretically abstract that they are useful for others to reflect on and take forward.

Finally, what of the concept of transformation? While I have made transformation the central focus of this thesis, empirically, it is not always in the foreground. Of course, through the research process, I did experience some resistance. As I have shown through this thesis, *Invisible Worlds* was constructed in a very labile and strategic way, being able to shift to adapt to different situations. Amongst some members of the team, I sensed a hesitancy to pin transformation down, lest it be another commitment against which the exhibition may be measured. Whether we call it transformation or not, through the Delphi process, we did reach a degree of consensus about the kind of change we might expect from visitors to *Invisible Worlds*, which was able to be challenged through the research. In any case, there were both practical and theoretical reasons for maintaining transformation as a central theme. Practically, the Eden project is infused with the language of transformation, at least in how they talk about themselves externally. From a

theoretical standpoint, transformation is a form of personal change which does not require knowledge transfer, neatly side-stepping the deficit issue which still mars much of science communication scholarship. But transformation was a starting point of the research journey – a sensitising concept. Following grounded theory methodology, it was necessary to, at least for a while, see in which directions the empirical reality of *Invisible Worlds* took us. From our new vantage point, we can look back and see how our new perspective on transformation might be useful to us.

8.2 Constructing the visitor

8.2.1 The public engagement perspective

The production of *Invisible Worlds* presented several overlapping and sometimes contradictory constructions of visitors – variably diverse, stupid and disinterested, regulatable, consumers, and 'us'. To explain these different constructions, it is instructive to refer to Adele Clarke's concept of the implicated actor, someone who is discursively constructed within a social world but remains silent (Clarke, Friese and Washburn, 2017, pp.76–77). Clarke makes the distinction between two types of implicated actors – those physically present but silenced or ignored, and those not physically present and therefore entirely discursively constructed. The implicated visitors in the production of *Invisible Worlds* fall somewhere between these two categories. While visitors were certainly not physically present in the exhibition production process e.g. in planning meetings etc. people who visit the Eden Project are ubiquitously present at the Eden Project site. This distinction highlights a geographical peculiarity of the Eden Project, in that the main staff offices are housed in a building perched high on the rim of what once was a China clay pit, with the visitor attraction below. While belonging to the same site, exhibition development staff and visitors inhabit neighbouring but very separate physical worlds. To silence or ignore the physical presence of visitors required no special effort on the part of exhibition development staff – in fact it is physically effortful to undertake the considerable walk 'on site' and the steep ascent on return. Without overstating the influence of the geographical arrangement of the site, it is raised here to note that the physical separation of visitors and staff meant that acknowledging the agency and

physical presence of visitors was always interventional and exceptional, despite their ubiquity and physical closeness.

Considering the multiplicity of discursive constructions seen in the *Invisible Worlds* team, Adele Clarke suggests asking the question, 'Whose constructions of whom/what exist? Which are taken as the "real" constructions or the ones that matter most in the situation by the various participants? Which are contested? Whose are ignored? By whom?' (Clarke, Friese and Washburn, 2017, p.77). These questions arguably imply relatively fixed, self-consistent constructions of implicated actors, which 'belong' to certain powerful actors within a social world. Such a conception of implicated actors lies in contrast to recent theorisations in public engagement with science which posit actors as emergent (Horst and Michael, 2011), being constructed through processes of differentiation and identification (Michael, 2009). Mike Michael (2009) has argued that the patterning of publics resulting from these processes mean that, at least theoretically, any construction of the public is possible. Empirically, this is borne out in apparent inconsistencies in constructions of publics, with different discourses being mixed in talk, sometimes even within the same utterance (Burri, 2018; Davies, 2008), as well as the resulting difficulty in assigning these constructions to different actors in a one-to-one fashion (Burri, 2018). The multiple, overlapping, and sometimes contradictory constructions of visitors by the *Invisible Worlds* team further support these findings. Arguably, neat distinctions between and fixity of constructions of 'publics' or 'visitors' are an artifact of the analytic process, which re-constructs the visitor in a form which is amenable to interpretation. Alternatively, it is noteworthy that the construction of visitors in *Invisible Worlds*' production was relatively labile and to an extent resisted solidification, in contrast to Lezaun and Soneryd's (2007) finding that public engagement tends to produce a static, unified public. In either case, the production of *Invisible Worlds* suggests an ambivalence towards the figure of 'the visitor' which problematises Clarke's relatively fixed conception of implicated actors.

Nevertheless, it is important to consider how visitors were variably constructed and to what end, because constructions of the public, however ambivalent, materially impact engagement objectives and mechanisms (Barnett et al., 2012). Burri (2018)

has hypothesised that diversity of constructions may be attributable to individual differences and variable identities. The present research disagrees with this assertion – while individual differences may be a source of variation, they fail to explain to what ends different constructions are used. The present research supports the assertion that constructions of the public, and of visitors, have a discursive function, which operates beyond individual differences. Furthermore, while any construction may be possible (Michael, 2009) relatively few are empirically reproduced. The figure of the idiot, as introduced by Lezaun and Soneryd (2007) holds resonance with *Invisible Worlds*' constructions of the visitor as diverse, stupid and disinterested, and regulatable, as the only legitimate constituency who will behave as expected and represent a 'general public'. Lezaun and Soneryd note that when public engagement faces challenges there are one of two choices – changing the model of engagement, or changing the public. They show how selective recruitment of participants in public engagement serves to change the public via exclusion of stakeholders.

In the production of *Invisible Worlds* we see something different. As a visitor attraction which boasts broad public appeal, physical exclusion of publics is neither desirable nor possible. Rather than explicit material change in the public, we see strategic (although not necessarily conscious) discursive change in constructions of visitors to suit the issue at hand. For example, when the level of content presented in the exhibition was questioned by Wellcome, the intelligence and knowledge of visitors was minimised to explain how the level was appropriate; when discussing the exhibition's ability to attract more visitors, the visitor became one of many regulatable units subject to 'flow' and 'capacity'. On one hand, this shows a great deal of flexibility, spontaneity and ingenuity in the construction of the visitor in order to get the work of producing *Invisible Worlds* done. However, such constructions also have significant impact on the content and design of the exhibition, the material construction of which can act to manage visitors' behaviour and delimit what counts as an acceptable performance of being a visitor (Barnett et al., 2012). While not being explicitly exclusionary, as Emily Dawson (2014, 2018) has found, left unexamined, such processes may serve to exclude in more subtle ways. By this, I make no assertions about the inclusivity of *Invisible Worlds*, but rather I intend to

highlight how unproblematised and ambivalent discursive constructions of visitors can materially impact exhibition production with the potential for unintended consequences.

What, then, can be said about the intention of constructions of visitors in *Invisible Worlds*? Davies (2008) found that scientists construct publics in diverse ways, with the commonality that their constructions serve to reproduce the epistemic authority of science. Barnett and colleagues (2012) have similarly noted that variable constructions of the public re-frame the science-public relationship whilst maintaining the power differential, which places science as authoritative and forecloses public incredulity. Again, in the same vein, Mogendorff and colleagues (2012) found that scientists relate and identify with lay publics as a way of giving legitimacy to their rejection of lay concerns and limiting the public's role to a binary of either accepting or rejecting science. While similar processes may be at play at the Eden Project, the exhibition development team were neither scientists nor publics; the team was not invested in maintaining the authority and institutional legitimacy of science *per se*. During *Invisible Worlds*' production, 'science', at least to the extent to which it was used in the exhibition, was still seen as something that was new to Eden. Rather, it makes more sense that the Eden Project adopted science as a signifier of epistemic authority to the end of legitimising *Invisible Worlds*, and by extension the Eden Project, as an institution which can speak authoritatively on environmental issues. In short, the diversity of constructions of visitors worked to reproduce the institutional legitimacy of the Eden Project.

In any case, there was a tendency in *Invisible Worlds* to characterise visitors as deficient in one way or another, variably lacking knowledge, intelligence, attention span, agency, individuality, and so on. Overall, this paints a picture of the visitor well in line with the deficit model. However, it is important to note that such characterisations neither necessarily represent a perception of moral inadequacy of visitors, nor a judgement on the *Invisible Worlds* team. Viewing constructions of visitors as a product of institutional legitimation processes shows how such labile constructions of visitors, used strategically, are necessary, serving both the explicit process of exhibition production as well as tacit processes of institutional

legitimation. As an example, characterising visitors as 'us', allowed the exhibition team to legitimately draw on personal experience to make pragmatic decisions about the content and structure of *Invisible Worlds*. At the same time, similarly to the findings of Mogendorff and colleagues (2012), identifying with visitors allowed for, when necessary, the rejection of visitors' interests, and the strengthening of Eden's epistemic authority.

This two-headed process of characterising visitors in *Invisible Worlds* had two main implications. First, characterising visitors functioned as a bridge between the explicit process of building and actualising the exhibition's narrative, and the tacit processes of institutional legitimation. As such, it represents one of the main processes through which tacit institutional legitimation exerted influence on the content, structure and form of the exhibition. Second, the discursive functions of visitors suggest that deficit-laden constructions may be resistant to change without addressing the underlying processes which bring such constructions into being and make them strategically useful. In sum, these implications underscore how science communication can have diverse personal and political aims with scope far beyond simple transfer of information (Davies, 2019b; Weingart and Joubert, 2019).

8.2.2 The museum perspective

Thus far, I have commented on the construction of visitors primarily through the lens of literature on public engagement with science. Now I move to discuss the literature on the specific substantive context of museums, which offers a complementary but differing view. Zahava Doering (1999) made an interesting early intervention into this discussion by introducing three interpretive categories of visitors – strangers, guests and clients. While the visitor as stranger situates the museum as responsible for its collection, not the public, the guest and client categories suggest increasing degrees of accountability to the visitor, either through education as a guest, or through meeting wants and needs as a client. Doering identified a trend towards treating visitors as clients, and advocated for the continuation of this trend to revitalise the museum through change. Quoting the work of Michael Conforti (1995 quoted in Doering, 1999) on the survival of museums as institutions, Doering noted that

structures in museums which resist change are ‘simultaneously stabilizing and constricting’ (Doering, 1999, p.85). Characterising visitors within *Invisible Worlds* was one such process, which was both enabling and constraining. On one hand, it was enabling because it secured legitimacy and justified the institution’s intervention. On the other hand, it created a limited conception of the visitor shrinking possibilities for novel engagement. As I will argue later in this chapter, when viewed through the lens of institutional work, it is not just that such processes are barriers to change, but that it is their function to maintain institutions in resistance to change.

One of the first and most extensive treatments of the construction of visitors in museums was Sharon Macdonald’s (2002) ethnography of the production of an exhibition at the Science Museum. As in the present study, MacDonald found that the construction of the implicated visitor went beyond simple definition of target audiences and visitor profiles. MacDonald evoked what she called the ‘phantom public’, which can be seen as a special case of Clarke’s implicated actors, discussed above (Clarke, Friese and Washburn, 2017), creating the figure of a ‘standardised’ or ‘ideal’ visitor, often portrayed as disruptive, stupid, ignorant or deviant to reinforce divisions between insiders and outsiders, museum professionals and visitors (Macdonald, 2002). While my interpretation of *Invisible Worlds* builds on MacDonald’s assertions, I underscore how in *Invisible Worlds* there was no one figure of the ‘ideal visitor’, but that constructions of visitors were rather labile and strategic. While MacDonald did mention contradictions in the Science Museum team’s construction of the visitor, these contradictions remained largely unexamined due to a desire to understand direct cause-and-effect relationships between practices and results (Macdonald, 2002). In contrast, the present research assumes no such relationship between process and outcomes, and shows instead how multiple, sometimes contradictory, practices and ways of thinking coalesce to form one result (the exhibition).

Additionally, the present research highlights how visitors are characterised not just through differentiations between museum and visitors, but also through identification with them. MacDonald (2002) observed this in part through what she called the ‘ordinary visitor equivalent’, for example she found women (implicitly mothers)

working at the museum were often seen as good proxies for visitors, while actual visitors were seen as potentially disruptive. Interestingly, MacDonald documented one of the Science Museum's first attempts at formative evaluation, which limited visitor involvement to defining, for example, topic areas, requisite knowledge level and familiarity. There are parallels with the Eden Project, who in *Invisible Worlds* asked visitors about topic preferences and assessed level of comprehension for exhibit text relatively late in the production process, while visitor participation in other areas was limited. MacDonald (2002) attributed the limited involvement of 'real' visitors to the pre-existence of 'virtual visitors who were already imagined into the exhibition, whose desires, boredom thresholds and 'reading levels' had already been decided upon' (p. 171). The present study adds flesh to this assertion by suggesting that it is not just the pre-existence of imagined visitors, which precludes the involvement of 'real' visitors, but that the imagined visitor performs discursive, institutional functions which real visitors cannot. As such, contradictory institutional demands, such as pressure to demonstrate success, uncertainty over future funding, precarity of individuals' positions, fragile project teams and restrictive production timelines can preclude the impact of efforts such as formative evaluation (Davies and Heath, 2014), and narrow constructions of the visitor.

The figure of the ideal visitor has been more recently described as someone who is independent, self-directed, with variety of choice in learning and leisure options (Grek, 2009), or even confident, extroverted, playful and risk-taking (Scott et al., 2013). Such characterisations are consistent with ideas of the post-museum (Watermeyer, 2012), which emphasises visitor choice over linear, pre-defined narrative, and is reflected in the non-linear narrative structure of *Invisible Worlds*. This presupposition of a highly proactive visitor created a tension within *Invisible Worlds*. It was pre-empted that visitors may choose their own path through the exhibition, seeing some exhibits, while passing by others. Much effort was made to ensure that each individual element of the exhibition was sufficient for visitors to 'get' the overall narrative of the exhibition. The resultant web-like, fractal structure of the *Invisible Worlds* narrative rendered visitor choice functionally obsolete. The kinds of choices the ideal visitor was allowed to make were superficial choices around

preferences, rather than the wider social implications of the exhibition's narrative (Grek, 2009). Such an approach treats the visitor as a consumer, and may erroneously conflate choices between, for example media, topics and levels of engagement with democratic citizenship (Macdonald, 2002). In any case, the figure of the ideal visitor, as interested in superficial choice-making, forecloses alternative readings of the exhibition (Jaeger, 2020). We see reflected in the ideal visitor one of Bauman's challenges to empowerment within liquid modernity - while the ideal visitor is able to choose, the agenda of choice-making lies out of reach (Bauman, 2000). That is not to say that the choices visitors may make are not real or meaningful in themselves, but that they are of little value when each choice leads to the same conclusion.

It is important to remember that the ideal visitor does not exist as a real person out there, but is constructed more or less consciously through the museum (Hansen-Glucklich, 2014). Nevertheless, the ideal visitor has very real material consequences as the imprints of multiple discursive visitors congeal into one physical form of the exhibition. The materiality of the exhibition projects the figure of the ideal visitor onto actual visitors, giving a sense of who belongs, and who does not (Birmingham, 2016). The expectations about who visitors are and how they should behave become embedded throughout the exhibition, making things difficult for those who do not conform (Dawson, 2014) and reproducing structural inequalities (Dawson, 2018).

8.3 Situating ambition negotiation

Recently, it has been recognised that, with increasing professionalisation, organisations play an important role in science communication (Schäfer and Fähnrich, 2020). While this perspective has largely been associated with journalistic and strategic communication of scientific institutions (Rödder, 2020), it is equally applicable to organisations such as the Eden Project, which may use science to represent their own interests separate from science itself (Horst, 2013). Contemporary museums must navigate many complex and contradictory tensions (Clover, 2015), one of those being the need to maintain funding, which is particularly pertinent for non-government funded institutions such as the Eden Project.

Furthermore, museums must justify their existence with an increasingly commercialised audience (Christensen-Scheel, 2018). As such, there is motivation to create a strong reputational brand around an organisation to secure not only future funding opportunities (Koivumäki and Wilkinson, 2020), but public attention and legitimacy (Schäfer and Fähnrich, 2020).

Schaefer and Faehnrich (2020) provocatively refer to such science communication practices which happen separate from scientific institutions as 'basking in the light of the latest scientific and technological developments' (p. 139) in a way which suggests that science may be illegitimately co-opted for otherwise shadowy motives. While I do not discount this as a possibility in some cases, as can be evidenced by the significant interest around fake news and popular anti-science movements, I argue that it is important to recognise that otherwise earnest efforts at science communication equally benefit from the epistemic privilege granted by science (Suldovsky, 2016). Organisations such as the Eden Project, which may serve purposes separate to science, such as being an entertaining visitor attraction and promoting an environmental message, play a significant role within the ecology of science communication at large, using science to strategically legitimate their own interests (Faehnrich, 2018).

For example, within *Invisible Worlds*, science was used to legitimate Eden's own ecological vision (Tam, 2019) of humans being intimately connected with the environment, while at the same time framing this connection as ultimately unknowable without science. By so doing, The Eden Project's intervention through *Invisible Worlds* is rendered necessary in a way which can attract the accrual of resources, such as funding, to further the Eden Project's aims. By so doing, *Invisible World*'s narrative served to de-legitimise other environmental knowledges, and, through 'what's in it for me'-style tropes, legitimate the individual economic potential of natural resources (Tam, 2019). As my investigation has shown, however, science was only a small part of a much larger whole. A tacit process of ambition negotiation undergirded the production of *Invisible Worlds*. This enabled the production work to be done, in which science only played a small part. This process consisted not only of setting, moderating and checking the ambition level of the project, but also

employing strategies to realise this ambition, such as building trust, adopting flexible working strategies, and discursively positioning the project and the organisation within or without social worlds.

Overall, this process represented a complex, ongoing negotiation over the meaning and significance of ambition, with both discursive and material consequences. In line with the symbolic interactionist influences on the present study's methodology, I refer to this negotiation over whether *Invisible Worlds* was ambitious as framing, and the ambition of the project as a frame, that is the components which organise perception of a situation (Goffman, 1956). While framing has been explored amply in relation to how science itself is framed within science communication (Davis and Russ, 2015), what I refer to here is the framing of the communicative act itself (in this case of the *Invisible Worlds* exhibition as ambitious) as a form of institutional maintenance work (Nite, 2017).

Institutional work is a concept introduced by Thomas Lawrence and Roy Suddaby (Lawrence and Suddaby, 2006) to explain the 'the purposive action of individuals and organizations aimed at creating, maintaining and disrupting institutions' (Lawrence and Suddaby, 2006, p.215). In this context, they define an institution as made up of patterns of sequenced action supported by mechanisms of control. At the Eden Project, the institution at stake was the Eden way of doing things, which was characterised as being unconventional and informal, at odds with what a 'traditional' science centre might do. Lawrence and Suddaby outline six hypothetical mechanisms which maintain institutions (Lawrence and Suddaby, 2006):

- Enabling – Creating rules that support the institution.
- Policing – Enforcing compliance to the institution.
- Deterring – Creating barriers to institutional change.
- Valourising and demonising – Illustrating the normative basis of the instituton.
- Mythologising – Creating myths around the institution which maintain its normative basis.

- Embedding and routinizing – Incorporating the institution's norms into everyday routines and practices.

I argue that the framing of the *Invisible Worlds* project as ambitious, and the subsequent maintenance of that frame served to perpetuate the institution of the 'Eden way of doing things' in the face of external pressures such as increased professionalisation and competitiveness of the field. Discursive framing of this kind is a powerful mechanism through which challenges to institutions become delegitimised, while the institution itself is defended and reified (Nite, 2017).

Looking through the lens of institutional work allows us to attend to practices and processes (Lawrence, Suddaby and Leca, 2011) in a way which embraces the multiplicity of motives behind science communication (Davies, 2019b; Weingart and Joubert, 2019), appreciating that not all science communication is simply by or for science. At the Eden Project, the negotiation of the ambition of *Invisible Worlds* was an important process which, while involving science at its periphery, was much more about positioning the Eden Project within social worlds and maintaining its institutions, than the accurate dissemination of scientific knowledge. This approach at its core calls back to early work in science communication studies (Wynne, 1995), which sees social relations and institutional legitimation as foundational concepts in science communication, not the accurate transmission of scientific facts.

What the present study adds to this foundation is the suggestion that science communication is not just a legitimation strategy in the service of science. Building on recent research, which recognises that those outside scientific institutions also use and communicate about scientific knowledge in a way which suits their own ends (Faehnrich, 2018) it does not make sense to only describe science communication in reference to science and scientific institutions. Science communication forms and maintains its own institutions, 'patterns of sequenced action supported by mechanisms of control' (Lawrence and Suddaby, 2006), which may operate entirely separately from science.

Returning to the context of the Eden Project, it can be seen that ambition became a key normative property of *Invisible Worlds*, the maintenance of which was the subject

of much effort to ensure the legitimacy of the project. And while I emphasise the discursive elements of this process, that is not to say that it did not also have material implications. As seen in the extended example given in Section 5.4, the exhibition itself became a testing ground for competing ideas (Patriotta, Gond and Schultz, 2011). One successful exhibit, Infinity Blue, ultimately reinforced and reified Eden's ambitious way of doing things, while at the same time stabilising the discursive construction of ambition in physical form (Jones and Massa, 2013; Lanzara and Patriotta, 2007). Whilst, turning to the exhibition team themselves, we can consider how the high levels of stress may have promoted conformity to existing practices (Gill and Burrow, 2018) by limiting reflection in action, maintaining a performance of ambition through cycles of intense stress and relief.

8.4 Situating serendipitous wandering

Serendipitous wandering was the process by which visitors tried to understand *Invisible Worlds*. It was a process of creating an unexpected relational understanding of the exhibition, which extended beyond the immediate context and was able to be integrated into an ongoing life story. The main assertions of this theorisation are that visitors' attempts at understanding the exhibition were both serendipitous and embodied. While embodiment is discussed later in relation to the processes which constituted serendipitous wandering within *Invisible Worlds*, I first explore serendipity as a useful and under-theorised concept for science communication.

Visitors who found deeper meaning in *Invisible Worlds* did so serendipitously. That is to say that, entering with little preconceived idea about the exhibition, visitors described an element of surprise or unexpectedness in their discovery. The seemingly chance creation of deeper meaning raises important questions about science communication, such as the (in)significance of luck or chance, as well as how serendipity might be socially stratified and morally inflected (Merton and Barber, 2004). Serendipity also has an ethical character, in that chance discovery may weaken echo chambers and promote pluralism (Reviglio, 2019). While the present work does not necessarily provide solid answers to these issues, it does bring the significance of serendipity within science communication to the fore.

The phenomenon and discourse of serendipity in science communication has only received limited discussion across three separate perspectives. Firstly, serendipity has been used to describe communication efforts which may be opportunistic, unplanned, or reactive (Koivumäki and Wilkinson, 2020; Weitkamp, 2014; Wilkinson and Weitkamp, 2013). This conceptualisation of serendipity as chance opportunities for science communication may be associated with a negative moral inflection, implying a lack of planning, strategy, awareness, time or priority given to communication (Wilkinson and Weitkamp, 2013), while acknowledging serendipitous communication's potentially large impact and broad reach (Weitkamp, 2014). The second approach takes from informal science learning, and views serendipity from the perspective of publics, arguing that serendipity 'requires action on the part of the recipient—action to create favourable circumstances, action to recognise opportunities when they arise and action to capitalise on unplanned learning events in a timely manner' (Watts, 2015, p.344) This view suggests that serendipity does not just arise from chance alone, and places responsibility on publics to be active and make the most of opportunities. The third approach comes from Watermeyer's (2012) conception of the post-museum for science communication which considers serendipity in liminal spaces, outside of time, where 'the exposition of scientific knowledge occurs as a punctuation or interstice to daily life and as an evocative snap-shot triggering prolonged reflection' (Watermeyer, 2012, p.5). This final view of serendipity considers not the communicator or the public, but the nature of the environment where serendipity might occur. By interpreting visitors' experiences as serendipitous, the present study attempts to expand on this emerging discourse and phenomenon of serendipity and further understanding of public encounters with science as an embodied experience.

Despite relatively little attention in science communication, science studies more broadly have had a long-standing interest in serendipity as part of a wider concern over the nature of scientific discovery (Ziman, 2002), and the topic receives continued attention as an approach towards, for example, exploiting interdisciplinary collaboration (Townsend and Mikkonen, 2019). Likewise, information studies have shown interest in exploiting serendipity in digital systems to aid fortuitous information

discovery (Race and Makri, 2016). The arguably cautious approach towards serendipity in science communication, which may imply a lack of strategy or control, stands in opposition to how serendipity has been viewed within science itself. Here serendipity has generally valorised and mythologised the 'prepared mind' of a genius scientist (Merton and Barber, 2004), and remains a strong justification for interdisciplinary work and critique of narrow, neoliberalised research agendas (Weaire, 2006). The extended study of serendipity in neighbouring fields has shown that serendipity is a heterogeneous process, produced by different mechanisms (Yaqub, 2018), a skill which may be developed (Amacker, 2019; Rubin, Burkell and Quan-Haase, 2010), and a phenomenon which may be experienced at an everyday level (Rubin, Burkell and Quan-Haase, 2010), not just during significant scientific discovery.

The present study suggests one mechanism by which serendipity was created in *Invisible Worlds*, through a process of wandering and trying to understand, involving shifts in attention and an experiential sense of lack of control (Rubin, Burkell and Quan-Haase, 2010). Although much of the interpretation of visitors' experience refers to visitors making sense of the exhibition in a way which may imply a cognitive emphasis, it is important to acknowledge that visitors' attempts at trying to understand were as much embodied in movement through and within the exhibition space, as they were reliant on cognitive processes. As such, an attempt has been made to avoid an overly psychological interpretation, which would reduce serendipity to individual attributes possessed by visitors (Merton and Barber, 2004). Instead, seeing *Invisible Worlds* as a designed environment has allowed consideration of how the materiality of science communication interventions may provide (or hinder) opportunities for serendipity (Merton and Barber, 2004). In this way, the present study provides an empirical complement to Amacker's (2019) recent theorisation of serendipity as embodied, exemplifying 'surrendering to the now' through the act of wandering and allowing shifting attention to draw the body through the exhibition, and the relational creation of special moments, which create a liminal sense of presence (Amacker, 2019).

8.4.1 Anticipating the visit

Visitors entered *Invisible Worlds* with a positive sense of anticipation and excited expectation of varying intensity. While emotions have been implicated in both science communication (Davies, 2019a) and museum learning (Falk and Gillespie, 2009) research, they have only recently started to be explored in earnest. As discussed in the literature review, there is some disagreement as to the role emotions may play in the visitor experience, for example as a mediating factor (Falk and Gillespie, 2009), or as a constituent of the experience itself (Bastiaansen et al., 2019). The present study adds an additional consideration to this debate, in that emotion played an important role in how visitors defined the situation at the outset of the visit. This finding expands the temporal horizon of emotions typically considered in science communication, from, for example, awe and wonder (Davies, 2019a) experienced in the moment, to consider temporal emotions, which are felt relative to the past or the future (Lois, 2010). As Lois (2010) has argued, such emotions give continuity and durability to feelings, allowing for the construction of a continuous self over time. If science communication research is to consider identity (Davies et al., 2019) and identity change seriously, as might be expected from a transformative perspective (Illeris, 2014a), it is therefore vital to take temporal emotions into account.

The sense of anticipation experienced by visitors can be interpreted as a positive, future-related emotion arising from a situation around which there was uncertainty (Forrest, 2015; Gnoth, 1997), which is not easily amenable to cognitive rationalisation (Gnoth, 1997). Expectation and anticipation are important because they motivate both discursive and embodied activity and provide an affective reference against which the relative success of an experience may be measured (Skinner and Theodossopoulos, 2011). As Gnoth has theorised, such expectation is formed in the space between the ‘real’ and ‘ideal’ selves, and may be met through general classes of experience, rather than specific actions (Gnoth, 1997). This perspective presents quite a different view of the visitor experience than, for example, Falk’s identity-related motivations (Bond and Falk, 2013; Falk, 2009), which attribute well-defined motives to visitors, based on specific needs. In *Invisible Worlds*, visitors did not easily

fit into any one category. Instead, in talk they rapidly flipped between any number of identity-related motivations, showing a marked ability to switch from the absurd to the profound, as needed in the present moment (Skinner and Theodossopoulos, 2011).

The uncertainty around the visit generated a certain amount of ambiguity around the definition of the situation, which most visitors typified as a 'day out', with little further specification. I argue that this ambiguity is a characteristic feature of science communication and public engagement in general. For example, Sarah Davies (2019a) has recently argued that most of the energy of participants in science communication is spent negotiating the meaning of the engagement. Nevertheless, I do not see ambiguity, nor efforts by participants to resolve it as a negative that distracts from engaging with 'content' (cf. Davies, 2019a). Rather, the pervasive ambiguity, which characterised visitors' anticipation of *Invisible Worlds*, motivated and patterned behaviour (Ball-Rokeach, 1973). Indeed, Irwin and Horst (2016) have argued that ambiguity in public engagement can 'provoke debate and create energy' (p.76), providing an impetus for engagement in itself. The act of exploring and negotiating the ambiguous definition of the situation communicates as much about the relationships between science and society as discursive content. It is within this ambiguity that visitors can find the space between 'real' and 'ideal' selves (Gnoth, 1997), where the visitor is free to temporarily try on and perform different roles and identities (Skinner and Theodossopoulos, 2011), where identity can be established, maintained and re-created (Bond and Falk, 2013).

8.4.2 Wandering around; trying to understand

Beyond the initial affective frame of the visit, visitors experienced *Invisible Worlds* in a more-or-less consistently patterned manner. An initial orientation was followed by a cyclical process of concurrent movement and sense-making, with corresponding shifts between unfocused and focused attention and movement. Based on how visitors described their own experiences, I called these related processes wandering around and trying to understand. Interestingly, these processes correspond almost directly to those observed by Davies (2019a) in her recent ethnographic study of

emotion work in visitors to a science festival. In her field notes, Davies described, ‘There is a particular kind of ‘wandering’ walk, which is very distinctive… You walk slowly, almost staggering, with a side to side movement; you take your surroundings in but are not committing to anything’ (pp. 15-16). Davies interprets this movement as a ‘dance’, or negotiation between engagement and disengagement, particularly in relation to the performance of emotions. The present work supports and builds on this interpretation. Taking a more overtly phenomenological perspective, and drawing on ideas around the liminality of both serendipity and affective ambiguity, we can start to understand how visitors feel and experience this wandering, broadening beyond emotion work to think about how this ‘dance’, in some cases, helps visitors to create deeper meaning.

One theoretical concept, which has been useful in understanding this process, is that of affordances, which stems from James Gibson’s foundational ecological psychology (Gibson, 1979). Affordances are relational properties which suggest possibilities for action between humans (although Gibson generalises this to all animals) and their environment (Lombardo, 2017). As a simple example, the material configuration of a chair affords sitting. In this way, thinking in terms of affordances allows us to bridge between materiality and meaning, objectivity and subjectivity (Lombardo, 2017). In the example of the chair, while its hardness, size and the angles of its surfaces may be objective physical properties, the affordance of being somewhere to sit can only be defined in relation to the needs and abilities of the human body; the resulting meaning of a chair as a comfortable or relaxing place to rest leads further into subjectivity. Nevertheless, it is at least in part the physical properties of the chair which create the affordance of sitting – while not pre-determined, the physical configuration of the chair pre-supposes meaning (Lombardo, 2017). Thomas Lombardo’s interpretation of affordance theory (Lombardo, 2017) suggests that perceiving affordances is a pre-cognitive process, which does not rely on rational classification or conceptualisation, and requires perception of the whole thing, not just its individual parts (one does not need to individually measure the hardness, angle etc. of a surface to determine that it can be sat upon).

Explaining visitors' experience in *Invisible Worlds* using affordances, we can see how visitors' movement through the space was structured by perceiving and taking advantage of affordances provided by the material environment of the exhibition. Trying to understand was not limited to cognitive understanding of scientific content, but instead meant understanding what can be done here (Davies, 2019a). In other words, visitors were trying to understand what *Invisible Worlds* affords. This finding from *Invisible Worlds* at least partially supports previous work which used affordances to explain attention, meaning-making, and space in a museum context (Achiam, May and Marandino, 2014; Cardiel et al., 2016; Tröndle, 2014). Visitors in *Invisible Worlds* went through multiple stages of attention, allowing their attention to be drawn or focusing in more keenly (Cardiel et al., 2016). The visit was characterised by rhythmic movement through the space (Tröndle, 2014), punctuated by stillness as attention drew visitors in to particular exhibits. As visitors tried to understand, if successful, they created successively generalised and abstracted levels of understanding (Achiam, May and Marandino, 2014). All the while, visitors perceived the affordances of the exhibition, which structured their movement (Cardiel et al., 2016; Tröndle, 2014).

The present study nevertheless adds to these findings in a number of ways. Firstly, by taking the perspective of the visitor, the approach of the present study more explicitly incorporates embodiment and affect as felt and experienced by visitors. By so doing, it has been possible to understand how the embodied experience of the exhibition shapes understanding. Rather than seeing the material configuration of the exhibition and individual factors as deterministic, visitors' experiences in *Invisible Worlds* show how ambiguity opens up space for unexpectedness and serendipity, as well as how failed attempts at trying to understand may lead to filtering and rejection, and an understanding of the exhibition as 'not for thickos like us'. Secondly, visitors' descriptions of their experience show how the visitor experience is not just composed of successive individual opportunities for interaction, or individual physical properties of the exhibition, but that the experience consists of the perception of dynamic, relational wholes, which when in harmony are perceived as 'special moments' (c.f. serendipitous 'sense of presence' Amacker, 2019).

These ‘special moments’, such as the feeling of excitement around the Infinity Blue sculpture, could not be broken down to their individual properties. Rather, as argued in the visitor results chapter, they consisted of the relational combination of aesthetics and affordances, experienced as an intensity of affect and representing more than the sum of their constituent parts. Together, the experience of ‘special moments’ could be described as the ‘atmosphere’ of *Invisible Worlds*, ‘something indeterminate in a certain sense, something diffuse, but precisely not indeterminate with respect to what it is, its character’ (Böhme, 2017, p.14). The atmosphere of an exhibition, as theorised by Gernot Boehme and applied by Regan Forrest (Böhme, 2017; Forrest, 2013), has many parallels with the concept of affordances. Atmosphere is created by the relationship between visitors and the exhibition environment (Forrest, 2013); atmosphere is not a property which is simply attributable to one of either the environment or the people within it (Böhme, 2017); atmosphere is perceived bodily, and without the need for cognitive rationalisation (Böhme, 2017).

By tracing how visitors perceived and navigated affordances in *Invisible Worlds*, and how this process in some cases created ‘special moments’, I argue that atmosphere can be understood as being made up of constellations of affordances. This understanding is important because the atmosphere of a place communicates appropriate dispositions and behaviours (Böhme, 2017), for example a sombre atmosphere conveys a sombre disposition. Taken to its extreme, Böhme (2017) even suggests that communication itself is not just transfer of factual content, but the creation of a shared atmosphere which pre-supposes certain actions and relationships between communicators: ‘primarily at stake here are neither information exchange nor verbal interaction, rather, above all the act of talking in itself… its main purpose is the actualization of an underlying interpersonal atmosphere’ (Böhme 2017, p. 106). In other words, through *Invisible Worlds*, we can see communication as the creation of shared constellations of affordances. By seeing the atmosphere through the lens of affordances, it becomes possible to trace how the materiality of an exhibition, its affordances, and visitors’ attempts at understanding intersect to create the experience of serendipitous wandering. While

the turn of phrase, 'the medium is the message' is perhaps a cliché, in sum, the perception and navigation of the constellation of affordances provided by *Invisible Worlds* created a pre-supposition of meanings, behaviours and relationships, which preceded the discursive content of the exhibition.

Nevertheless, visitors of course did engage with the exhibition's discursive content. Visitors tested perceived affordances to identify what was possible and permissible, and created relations between their current experience, memory, imagination and identity. In this process, some visitors made successive imaginative leaps, forging successively more abstract and distant links between the immediate context of *Invisible Worlds* and their wider life experience (Achiam, May and Marandino, 2014). Unlike Achiam and colleagues (2014), however, who hypothesised that new levels of cognition were a result of a lack of support for visitors' existing understanding, visitors in *Invisible Worlds* who were able to make more abstract conceptual leaps experienced a feeling of congruence and reinforcement, which allowed them to embed their exhibition experience within a converging network of relations. By so doing, they performed and rehearsed identities (Bond and Falk, 2013). It was these visitors who experienced *Invisible Worlds* as more deeply meaningful. In one sense, it can be said that these visitors understood the exhibition, not in the reductive sense of cognitive knowledge acquisition, but that they gained a sense of resonance between their internal reality and the external reality of the exhibition (Soylu, 2016) – 'an intuitive sense of the affordances of elements in a conceptual landscape and their casual interactions.' (p. 8).

Finally, following the visit, those who described their experience as most deeply meaningful were those who were able to integrate their experience in *Invisible Worlds* into an unresolved narrativised life story. This finding is based on a smaller subset of data, so remains tentative and hypothetical. Nevertheless, it raises interesting points, which may direct future research. While narrative has long been identified as important in science communication (Constant and Roberts, 2017; Dahlstrom, 2010; Saffran et al., 2020), its importance has largely only been recognised in terms of the narrative content of science communication outputs. For example, previous work has explored how narrative may be used to persuade

(Dahlstrom, 2010) or increase perceptions of authenticity (Saffran et al., 2020). Narrative discourse has even been contrasted with scientific discourse, which is assumed to be logical and context free (Constant and Roberts, 2017), perhaps disregarding that science itself is subject to its own narrative conventions. In any case, the importance of narrative has been acknowledged as creating 'a critical, reflective space where self-evaluation can take place' (Constant and Roberts, 2017 : p. 5). The present study tentatively suggests, however, that narrative is not simply conveyed to audiences passively, but that audiences construct meaningful narratives from their experiences, or perhaps more precisely that audiences construct narratives about their lives within which experiences of science communication may (or may not) be integrated. Therefore, while we certainly should not be asking 'whether facts are being successfully transmitted' (Davies et al., 2019 : p. 4), I argue that we should also not be asking what narratives are being successfully transmitted. Rather, in addition to 'focusing on the meanings that are created through particular public stories about science' (Davies et al., 2019 : p. 4), we should also be asking what stories can be told through public encounters with science. By so doing, we can gain a perspective of science communication as spontaneous, unpredictable and open-ended, acknowledging that science communication does not always start or end with science, and that through use it acquires new, independent meanings (Bucchi and Trench, 2021). In short, visitors' deeply meaningful experiences in *Invisible Worlds* provoke us to ask how everyday encounters with science allow us to tell stories about our lives.

8.5 Supporting visitor transformation in a context of negotiated ambition

Throughout the discussion thus far, not much has been said about transformation, which was identified as a key sensitizing concept at the outset of the present research. In this concluding section, I briefly discuss the findings from both the organisational and visitor sections of the project in relation to transformation.

Firstly, in the organisational context of negotiated ambition, we can understand transformation as a discourse, which supports maintenance of an ambitious framing.

Aiming to profoundly change visitors through their experience reflects Lezaun and Soneryd's (2007) finding that public engagement preferences public mobility (i.e. willingness and ability to change attitudes). Contemporary museums must navigate an increasingly complex balance of values (Clover, 2017) with an increasingly commercialised audience (Christensen-Scheel, 2017). What we see in *Invisible Worlds*, is that ambition negotiation, as one form of institutional maintenance work, is one way in which these tensions are navigated. While it would be easy to simply critique *Invisible Worlds* as being subject to a neoliberalised agendas (Illeris, 2006), I argue that the situation is more complex. Negotiating ambition was a necessary process, to keep the work of creating the exhibition going. By positioning *Invisible Worlds* as ambitious, it enabled funding to be won, trust from senior management to be earned and so forth. As discussed above, however, while on one hand enabling, ambition negotiation was also constraining. It perpetuated limited conceptions of visitors and re-produced deficit modes of working. Acknowledging this double-sided property of ambition negotiation suggests that while transformative discourse serves powerful purposes, un-checked, it can have negative unintended consequences. The discourse of ambitionambition (and by extension, transformation), without grounding, may be easily motivated by the whims of politics and funding (Dudzinska-Przesmitzki and Grenier, 2008). Instead, the present research, by looking at both the organisational and visitor perspective, can identify discrepancies between ambitious discourse and the experienced reality of visitors, so that they might be brought closer to one another.

In terms of visitors' experience, then, what can be said about transformation? While previous research has suggested museums as sites which may trigger a 'disorienting dilemma' (Soren, 2009; Smith, 2016; Herber, 1998 quoted in Taylor, 2010), the present research does not support this finding. This discrepancy is perhaps because research in this area has tended to assume in advance that the museum visit is the place where the transformative process begins, and seeks to find evidence to confirm this view. Taking a grounded theory approach meant letting go of this assumption. Instead, findings from *Invisible Worlds* suggest that, in some serendipitous cases, the visit experience supported personal transformations, which

were already underway. This finding suggests that museums may be better placed to respond to external disorienting dilemmas (Grenier and Hafsteinsson, 2016), than trying to create them de novo. This process agrees with Illeris' interpretation of transformation as identity change (Illeris, 2014a), as, through negotiating the liminal and ambiguous nature of the visit, visitors were able to perform and strengthen different developing identities (Bond and Falk, 2013) Much of visitors' experience also corresponds with Dirkx's conceptualisation of transformation as incorporating imagination and self-discovery through emotional exploration (Dirkx, 2001; Dirkx and Espinoza, 2017). As visitors wandered around and tried to understand, they experienced affective intensities (both positive and negative), which again, for better or worse, reinforced certain identities (e.g. as environmentally friendly, as a 'thicko'). The findings also correspond with Kevin Pugh's (2011) work on transformation in a museum context, which concludes that museum objects may be used to develop self-exploration. This is interesting in that Pugh's work is theoretically distinct from Mezirow's transformative learning theory (which is drawn upon by e.g. Illeris and Dirkx). The present research suggests a tentative unexplored link between the two conceptualisations.

To sum up, the present research contributes to the recent interest in embodiment within science communication (Davies, 2019b, 2019a), by showing how engagement with a science exhibition may support the creation of deeper meaning in a person's life. It has shown how the concept of affordances is useful in understanding how visitors' embodied experiences become meaningful through serendipitous wandering. It has also shown how discourses which promote science communication projects as highly ambitious may be necessary, but that they can also serve to re-produce limited conceptions of publics. Combining these two perspectives suggests an opening up of conceptions of publics as people who have full and interesting lives, in which engaging science may play a role. But it also suggests refocusing our ambitions away from attempting to directly provoke transformative change. As we exist in both a rapidly changing society, as well as on a rapidly changing planet beset by a multitude of wicked problems, science communication may find greater social meaning in taking the role of supporting publics through change.

9 Conclusion

9.1 Research quality and limitations

This thesis aimed to create an understanding about how we might better conceptualise transformation in science communication, and specifically in a science exhibition context. In this section, I discuss to what extent this aim has been met. To provide a framework for this discussion, I draw on evaluation criteria suggested by Charmaz (2014 pp.336-338) as appropriate for constructivist grounded theory studies.

Credibility – Credibility was established through the research process by in-depth engagement with the *Invisible Worlds* team, as well as with visitors to the exhibition, as presented in Chapters 4 and 6. Through a prolonged engagement with the Eden project, I was able to gain familiarity with their practices and ways of working.

One aspect of credibility to consider is the sufficiency of the breadth, depth, and volume of data generated. As noted in Chapter 4, the generation of data for the organisational aspect of the thesis had to be cut short. By so doing, the volume of data was perhaps less than had been intended. While the amount of data may not be as significant in a qualitative study than in a quantitative study, and even one instance of data may be enough to suggest a theoretical category, a limited volume of data nevertheless impacts analysis in two ways. Firstly, a lower volume of data may not allow for elaboration of the range or variation of a phenomenon. The present research only analyses one case, *Invisible Worlds* at the Eden Project, and so does not make any strong claims about how the phenomena identified might vary in other settings. Nevertheless, the curtailment of data collection hindered the exploration of variation in negotiating ambition at the Eden Project. Secondly, and following on from the first point, less data may impact the transferability of research findings to other settings.

The present research has addressed these threats to credibility in three ways. First, particularly relating to the organisational aspects of research, a range of data have been used, including interview transcripts, discussion transcripts, and documents.

This variety of data attempts to go some way to capture the range and variety of experience which was precluded by cutting the reflective discussion meetings short. Second, care has been taken during analysis to ensure that while specifics may not be directly generalisable, the theoretical categories developed (namely ambition negotiation) are sufficiently analytically abstract to be transferred and applied in other contexts. Third, detailed description of analysis has been provided, which demonstrates the strong links between data and analysis. The claims made throughout the thesis are clearly evidenced, so that the reader can judge for themselves whether the conclusions drawn are commensurate with the data. By so doing, the thesis has demonstrated a contribution which is theoretically sufficient, original and useful.

Originality – As highlighted in Chapter 2, the concept of transformation in a museum context is under-theorised, despite extensive work around transformative learning in adult education. This thesis offers a new perspective on the phenomenon and discourse of transformation in this context, which runs counter to previous ideas. The most significant contribution made by this thesis in this area is the idea that a science communication intervention might *support* transformative change, rather than incite it. Furthermore, the analysis of visitor data suggests the importance of serendipity in science communication, which while appreciated in fields such as information studies and science and technology studies, has not been explored within science communication to date.

From the organisational aspect of the thesis, the main contribution is the notion that processes of institutional maintenance may play a significant role in science communication practice. While classical science communication research has in the past indicated how science communication practice may play a role in the institutional legitimation of science, this thesis suggests that science communication practice itself is an institution which is subject to legitimation processes. Through the interaction with the production of *Invisible Worlds*, I have shown how these processes can narrow constructions of publics.

Resonance – Through detailed description of cases, I have attempted to portray the fullness of the experience of both Eden Project staff and visitors. Reflective

discussion meetings, described in detail in Chapter 3, were used to test out developing theoretical ideas to see how they resonated with staff. While not a 'member check' in a strict sense, this process ensured the developing analysis remained relevant to the experiences of the *Invisible Worlds* team.

Nevertheless, the research process presented several threats to resonance. The reflective discussion meetings had to be cut short when the team began working on other projects. The engagement with visitors was, while in-depth, necessarily brief. And in any case, a singular and finite description as presented in this thesis will always fall short of describing the totality of experience. Being as transparent about the research process is one way in which these threats have been ameliorated. Detailed descriptions of the research process (as given in Chapters 3 and 5) give the reader enough information to judge the sufficiency of engagement with participants for themselves, and show how the analysis was grounded in participants' experiences while stretching beyond surface-level meaning.

Usefulness – Much effort has gone towards ensuring the usefulness of the thesis findings, while also maintaining a high level of theoretical abstraction. Through the application of action research, several strategies have been used to ensure the usefulness and applicability of the research. For example, the Delphi process at the outset of the study gave the *Invisible Worlds* team direct control over the direction of the research. This process generated a new research question which motivated and guided the visitor portion of the thesis. In latter stages of the research, as previously mentioned, reflective discussion meetings were used to feed back to the team and reflect on the developing analysis.

Aside from operationalising usefulness through the methodology and methods chosen, the findings themselves have significant implications for science communication practice. Firstly, the implications of negotiating ambition suggest the need for greater reflexivity in science communication, to understand how maintaining science communication as an institution might serve to reproduce deficit-laden practices. For funders, it suggests a move away from hyper-competitive schemes which may motivate negotiating ambition and limit practice. Secondly, the concept of

serendipitous wandering, is a radical departure from traditional science communication which sees itself as the cause and publics' response as the effect. The idea of serendipity challenges this linear causality, and the notion of supporting change suggests new responsive modes of practice which rely on in-depth understandings of publics.

Having discussed the quality and limitations of the thesis, the following sections address each of the research questions directly.

9.2 How can we better conceptualise transformation in an exhibition context?

The Delphi process at the outset of the PhD generated the following definition of transformation:

> *Transformation is a change in how visitors see the world, the result of a visceral emotional engagement with the content of Invisible Worlds which sparks interest, curiosity and inspiration. It is this culmination of understanding and emotion that creates a 'penny dropping' or 'lightbulb' moment. While the size of the change is not important, it is a positive change with regards to their attitude towards and relationship with the environment, wanting to learn more and feeling empowered to make change. Transformation in Invisible Worlds is unique to each visitor, meeting them at their level, even if they are disengaged. It is a moment which can be built upon as they go throughout their lives.*

The findings suggest that some modification to this definition is warranted.

Firstly, while the findings support notions of the nature of the visitor experience, at least in exceptionally meaningful cases, involving visceral emotional engagement and the culmination of emotion and understanding, it was not simply about engaging with the content of the exhibition. Through a process which was both embodied and serendipitous, visitors made successively abstract links between the exhibition and their internal resources, memories and imaginations, going beyond just content. Contextual and conceptual aspects of the exhibition were just as important as its content. Moreover, the experience of deep meaning-making in *Invisible Worlds* was

less engaged with the content of the exhibition than it was with perception of its affordances, what it was possible to *do*, as guided and directed by attention.

The second point of difference lies in the attribution of causality. While the Delphi definition suggests that a visit to *Invisible Worlds* might cause transformation, this thesis does not support this claim. Rather, the findings suggest that an important part of a transformative experience in *Invisible Worlds* was integrating the experience into an already existing ongoing life story or change. Rather than instigating change, we can see the role of exhibitions like *Invisible Worlds* as supporting visitors through change.

Thirdly, the findings place the normativity of transformative change into question. While the working definition suggests a positive attitudinal change with respect to the environment, the findings reveal that transformation is much more personal and contextual. While the main example presented in Section 7.4 describes Pippa's journey to developing a closer connection with the environment, not all visitors shared this orientation. Visitors drew on a wide range of identities, both related to the environment and not, to make sense of their experiences. In short, any kind of transformation which may have been made was much more about visitors and their lives, and how they situated their visit within that, than it was about the exhibition itself.

Finally, the Delphi definition suggests that transformation meets anyone 'at their level, even if they are disengaged', that transformation might be accessible to anyone that visits. The findings show this not to be the case. As described in detail in Chapter 7, in some cases, *Invisible Worlds* alienated visitors, resulting in one extreme case in a visitor describing themselves as a 'thicko'. Aside from the positive aspects of transformation, this thesis has shown how the same process can lead to visitors filtering out the exhibition and becoming disengaged and alienated. That is not to suggest in any measure that these visitors are deficient. In fact, every visitor interviewed described rich and full lives, full of interest, and often discussed the themes of *Invisible Worlds* at length, despite their feeling of alienation. Rather, the findings suggest that the process of serendipitous wandering is more accessible to

some visitors than others. While the present study does not unpick this discrepancy in detail, it does suggest that embodied and cognitive factors may be promising avenues for future inquiry.

9.3 How does the exhibition team construct Invisible Worlds?

The construction of *Invisible Worlds* was an interrelated process of making visitors understand while negotiating ambition. In general, *Invisible Worlds* was constructed as *ambitious*. I have shown that this ambitious framing was necessary, for example in winning over the trust of senior management to gain autonomy to work on the project, or to accumulate resources such as funding. At the same time, ambition constrained the project by making commitments in a resource-limited context. Negotiating ambition therefore represented a form of institutional maintenance work which attempted to maintain the ambitious framing in spite of challenges. Strategies for doing so included discursive positioning of the Eden Project and *Invisible Worlds* within a social arena, the use of authoritative documents as a way to set and check ambition, as well as strategies of working together which built trust, such as the creation of commissioning panels.

9.3.1 How does this construction influence the exhibition itself?

The construction of *Invisible Worlds* as ambitious and the resulting process of negotiating ambition influenced the practice of the exhibition's development. Most notably, the process of characterizing visitors acted as a bridge between negotiating ambition and the process of developing the content and physical form of *Invisible Worlds*, making visitors understand. While constructions of visitors were labile and used strategically, as discussed in depth in Section 8.1, as ambition was negotiated, the visitor became narrowed, in some cases reproducing deficit-laden constructions. While it would be reductive to suggest that one construction or another directly caused certain features of the exhibition, a limited construction of visitors can be seen in, for example, the lengthy and painstaking process of simplification, as well as the relatively superficial consultation of visitors to define topics of interest and suitable level of content. In sum, a limited conception likely narrowed the affordances available to visitors.

Negotiating ambition relates to transformation in that we can see the concept of transformation, being profound change, as part of a discourse surrounding an ambitious framing. Equally, we can see how negotiating ambition may limit the affordances available to visitors. Seeing transformation in this way has important implications for practice. At the level of institutions and teams, the findings suggest a need for greater reflexivity and awareness around the impacts of institutional maintenance on project outcomes. While I do not suggest that such processes are negative in themselves (in fact, I have argued that negotiating ambition was necessary), I argue that greater reflexivity may bring institutional work in closer alignment with the lived experience of publics so that they might work productively together, rather than hinder one another. At the level of funders, this thesis suggests that a competitive funding environment may stifle innovation and reproduce practice which is not in the best interests of publics. Instead, exploring more open-ended funding models may provide a fruitful avenue for transformative practice.

9.4 What aspects of the Invisible Worlds exhibition design create transformation?

Transformation was created through a process of serendipitous wandering. This process was fundamentally embodied. As visitors were drawn through space, guided by their attention, they made connections which created (in some cases) deeper meaning. While the physical configuration of the space of *Invisible Worlds* is certainly something which influenced this experience, it would be reductive to recommend specific design features. The variation in visitors' experiences, both positive and negative, show that there is no one solution which would 'trigger' transformation. And so, while no attempt is made here to reductively or behaviouristically suggest one thing over another, the findings are suggestive of what it is worth paying attention to.

Serendipitous wandering was at its core a relational process. Visitors made relations between their experience and their internal resources such as imagination and memory. At the same time, the exhibition created an 'atmosphere' which was composed of the relational whole of a range of features which made up its affordances. It was perception of this relational whole, and its integration into visitors'

relational understanding which created deeper meaning. This finding suggests that rather than focusing on individual design features, it may be fruitful to consider the affordances an exhibition provides as a whole. As seen in Chapter 7, visitors used these affordances to construct and perform identities, the experience of which was in some cases integrated into a longer, ongoing identity change. Rather, then, than asking what individual design features might cause transformation, perhaps we should be looking at the exhibition as a whole and asking, what identities does this exhibition allow visitors to perform? What story about themselves can visitors use the exhibition to tell? Conversely, what is disallowed? What is not possible?

Perhaps most importantly, this thesis suggests that transformation is not something which begins with a visit to a science exhibition. In some ways this intuitively makes sense. The kind of profound change we might associate with the everyday meaning of the word transformation is typically limited to dramatic, life-altering events, not a fun 'day out'. Nevertheless, the results do support the idea that an exhibition such as *Invisible Worlds* could find profound meaning in *supporting* people already going through a transformational change.

9.4.1 How could transformation be promoted or increased?

With the above findings in mind, this thesis suggests several strategies which could be used to support transformation in an exhibition context.

- Given the unique nature of the meanings generated by visitors in this study, to support visitors, a deeper understanding of visitors and their lives is needed. This understanding could be achieved, for example, through in-depth formative evaluation, which goes beyond identifying superficial topic preferences to understand how the exhibition might meaningfully situate itself within people's lives. As an example, Grenier and Hafsteinsson (2016) investigated an exhibition in Iceland which responded to and supported those affected by the 2008 financial crisis. Such an approach repositions science communication as a response to public need, rather than a provocation.

- The findings of this thesis suggest that visitors are unlikely to enter an exhibition with a transformative experience in mind. While visitors in *Invisible Worlds* serendipitously created deeper meaning, future practice could consider designing *for* serendipity. In recent years, the field of information studies has become increasingly interested in how, for example, search engines which return exactly what you are looking for might be designed for the kind of serendipitous discovery that might be encountered when browsing the shelves of a library (Race and Makri 2016). Exhibitions could design in opportunities for visitors to have unexpected encounters and make unexpected links between seemly disparate ideas.

- Beyond designing for serendipity, ensuring accessible and inclusive design is another way that transformation could be supported in an exhibition context. While some visitors interviewed for this thesis had deeply meaningful experiences, others felt alienated. Supporting all visitors, with inclusive design and interpretation would go a long way to helping them to make meaningful connections to their lives. Doing so nevertheless presents a significant challenge, as the subtle messages about who science communication is for (or not) are re-produced by conventional practice (Dawson, 2014).

9.5 Summary

This thesis has reconceptualised transformation as a discourse and phenomenon which is acutely relevant if contemporary science communication theory and practice is to support publics in a changing world. The findings support and build on existing ideas around non-discursive and ecological science communication by providing a new perspective on both exhibition production and visitor experience. Negotiating ambition highlighted that science communication can not only be used to legitimate science, but that it is its own institution, subject to its own legitimation processes. These processes, arising in part from a competitive funding environment, shape constructions of publics and influence practice. Serendipitous wandering was the process by which visitors created deeper understanding of their experiences. This process highlights the serendipitous, contingent, and embodied nature of

experiencing science communication. It draws attention to a need to understand how an encounter with science communication might fit in to a person's full and interesting life, and how it can meet the potential to support them through change.

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Appendix 1: Participant Information and Consent Forms

Participant Information for Eden Project Staff

What does it mean to transform?

You are being invited to take part in a research study. Before you decide whether to take part, it is important to understand why the research is being done and what it will involve. Please read the following information and make sure you have understood it. Please ask if anything is not clear or if you need more information.

What it the purpose of the study?

Exhibitions like *Invisible Worlds* often claim to "transform" their visitors, and transformation is one of the key principles which drives the Eden Project's mission, but what does visitor transformation actually mean? This study, which runs from spring 2017 to spring 2019, will investigate what transformation means for the people involved in creating *Invisible Worlds*, and how they make sense of those ideas. There are lots of different people working on *Invisible Worlds*, such as exhibition designers, educators, artists and scientists, so part of the research will compare how these different groups of people think about how visitors might be transformed when they visit *Invisible Worlds*, and whether those ideas change as the exhibition progresses.

Alongside this, I will be doing some research with visitors about "visitor transformation". To make this research as useful as possible, I would like you to help develop the questions which the research will answer, and I will feed the results back to you.

Why have you been chosen?

You have been chosen because you are working on creating *Invisible Worlds*. Everyone who has a direct role in *Invisible Worlds* is being asked to take part.

Do I have to take part?

It is up to you to decide whether to take part. If you do decide to take part, you will be given this information sheet and be asked to sign a consent form. In general, you will be free to withdraw up to one calendar month after data has been collected without giving a reason. The results will feed into the next stage of the research, so after this time it will not be possible to withdraw. The withdrawal period may be shorter for some data, which will directly feed into the next stage of data collection. If this is the case, you will be made aware of it at the time. A decision to withdraw, or a decision not to take part, will not affect your role in the development of *Invisible Worlds*.

What will happen to me if I take part and what do I have to do?

If you take part, I will ask you to take part in several activities which I have described below.

- Coming Up with Research Questions

I want my research to be relevant to you, so I would like you to help me come up which some questions which my research could answer. In one of the project meetings I will introduce the research topic and then ask you to brainstorm some ideas. Once I have collated everyone's ideas I will send you an email asking you to anonymously rank and rate each idea and give a reason for your rating. I will then ask you to rate the ideas twice more, taking other people's reasoning into account. I will use this process to direct my visitor research and align it with your priorities.

- Interviews

I would like to find out what visitor transformation means to you, and to see if your understanding of transformation changes as *Invisible Worlds* develops. I would like to interview you three times during the research study, at the beginning, shortly after *Invisible Worlds* opens, and about one year after opening. Each interview should take about one hour.

During the interview, I will ask you to complete what is called a repertory grid. I will show you groups of three items, and ask which two are most similar, which is different, and why. The reasons you give are called "constructs", which I will write down. We will repeat this process until you can't think of any more constructs. At the end of the interview I will ask you to rate each of the objects you have seen for each construct you have given. I will take the handwritten grid to analyse it, and will audio record the interview.

If you would like a copy of your completed grids or your interview transcripts please let me know in advance so I can send them to you.

- Observation

While I am visiting the Eden Project I will be observing what is going on and taking detailed notes about what I observe. This is so that I can understand the development of *Invisible Worlds* as the project

progresses. It is important that you understand that any conversations which we have, or where I am present, could form part of this data, so if you don't want something to be included for any reason please let me know. All data will be confidential, and no business-sensitive information will be disclosed externally.

What are the possible benefits of taking part?

Hopefully you will find the research an enjoyable process. It is the hope that this research will be able to facilitate self-reflection as well as collective reflection and investigation of "visitor transformation". I have designed the research so that there are opportunities for you to express and explore your own ideas and questions, and I hope that means you will find the research results directly useful for your work. For example, many people find repertory grid interviews insightful, because it can reveal aspects of their own thinking which they hadn't considered before.

What are the possible disadvantages and risks of taking part?

This research is not looking for information which could harm you professionally, however your participation does carry a level of risk. This is because through the research we will be exploring, confronting and challenging our conceptions of "visitor transformation". The process may be challenging and different opinions may arise. We will be working in a small group for an extended period, so it may be possible for colleagues to identify your data, even if identifying information has been removed.

The intention of this project is to promote evidence-based change in practice and while I hope that taking part will be a very positive process with many benefits, change can also be uncertain and cause anxiety. Please consider the risks carefully before agreeing to take part.

As this is a collaborative process, please feel free to question my work as you see issues arising. You can contact me at any time to discuss if you feel your participation in this research will put you at particular risk at work, or if you have any other concerns.

Confidentiality will be maintained as far as possible, however if you disclose evidence of a criminal offence or serious professional misconduct, it may be necessary to share that disclosure to a relevant authority.

What if something goes wrong?

If you have a complaint, please contact my University Supervisor Clare Wilkinson (clare.wilkinson@uwe.ac.uk) in the first instance.

Will my taking part in this study be kept confidential?

All information which is collected about you will remain confidential. The consent form will ask you to indicate the level of anonymity that is preferable to you.

I will take your name and contact details so I can contact you to arrange the interviews, match your interviews to one another, and contact you with your data or the results if you wish. These details will go onto a list with a participant number which will be password protected and stored on a secure server. Only I will have access to the list and it will be deleted at the end of the study.

The grids which are produced in the interviews will not have your name on them, and the audio recordings will be transcribed and any identifying information will be removed or changed, so anyone looking at the data should not be able to identify you, should you choose to not be identified.

The data from the interviews will be primarily analysed by David Judge (david.judge@uwe.ac.uk), but other researchers at UWE and people working on *Invisible Worlds* will have access to the data, and the data may be used by other researchers in the future for academic research or research at the Eden Project.

What will happen to the results of the research study?

The results of the research may be published in academic journals, industry publications, at academic or industry conferences, to the public through outreach or public engagement, and will form part of a PhD thesis. If you would like to be sent a digital copy of the PhD thesis once it is completed, please let me know.

You may be quoted in any report/publication or presentation of the research, and your completed grids may be shown, however you will not be named, should you wish to remain anonymous.

Who is organising and funding the research?

I am a PhD student at the University of the West of England, Bristol, funded by the university and the Eden Project.

Contact for further information

David Judge, david.judge@uwe.ac.uk
Science Communication Unit, Frenchay Campus

Consent Form for Eden Project Staff

Please tick as appropriate:

Deciding to take part	**Yes**	**No**
I have read and understood the information sheet.	☐	☐
I am aware of the risks associated with taking part in this project.	☐	☐
I have been given the opportunity to ask questions about the project.	☐	☐
I agree to take part in the project. Taking part in the project will include being observed at work, taking part in discussions and surveys, and being interviewed. This will involve being audio recorded on occasion.	☐	☐
I understand that taking part is voluntary. I can opt in or out of any part of the study, and I can withdraw from the study at any time without having to give a reason.	☐	☐
I understand that I can withdraw data collected about me up to one calendar month after it has been collected, without having to give a reason, and that the data will be deleted and destroyed.	☐	☐
Using your information in this research		
I understand that my personal details will not be revealed to people outside of this project.	☐	☐
I understand that I may be quoted in publications, reports, web pages and other research outputs.	☐	☐

Please tick as appropriate:

I would like my real name and job title to be used in the above.	☐
I would like my job title to be used in the above, but not my real name.	☐
I would like neither my real name, nor my job title to be used in the above (you will be referred to as *Invisible Worlds* team member, *Invisible Worlds* narrator etc. or similar).	☐

Using your information in the future		
I agree that my data can be archived.	☐	☐
I understand that authenticated researchers will be able to use my data in the future, and that my confidentiality will be preserved.	☐	☐
I understand that authenticated researchers may quote me in publications, reports, web pages and other research outputs.	☐	☐

_____ _____

Name of participant Job title

_____ _____

Signature Date

_____ _____ _____

Name of researcher Signature Date

For more information please contact David Judge (david.judge@uwe.ac.uk). This PhD is being supervised by Dr Clare Wilkinson (clare.wilkinson@uwe.ac.uk) and Dr Emma Weitkamp (emma.weitkamp@uwe.ac.uk).

Consent Form for Eden Project Documents

Please tick as appropriate:

Deciding to take part	**Yes**	**No**
I have read and understood the information sheet.	☐	☐
I am aware of the risks associated with taking part in this project.	☐	☐
I have been given the opportunity to ask questions about the project.	☐	☐
I agree to take part in the project. Taking part in the project will include providing documents related to *Invisible Worlds* such as meeting minutes and other working documents on a case by case basis.	☐	☐
I understand that taking part is voluntary. I can opt in or out of any part of the study, and I can withdraw from the study at any time without having to give a reason.	☐	☐
I understand that I can withdraw documents provided up to one calendar month after they have been collected, without having to give a reason, and that the data will be deleted and destroyed.	☐	☐
Using your information in this research		
I understand that personal details and other confidential information will not be revealed to people outside of this project.	☐	☐
I understand that the documents provided may be quoted in publications, reports, web pages and other research outputs.	☐	☐
Using your information in the future		
I agree that the documents provided can be archived.	☐	☐
I understand that authenticated researchers will be able to use the data in the future, and that confidentiality will be preserved.	☐	☐
I understand that authenticated researchers may quote the documents in publications, reports, web pages and other research outputs.	☐	☐

_____ _____

Name of participant Job title

_____ _____

Signature Date

_____ _____ _____

Name of researcher Signature Date

For more information please contact David Judge (david.judge@uwe.ac.uk). This PhD is being supervised by Dr Clare Wilkinson (clare.wilkinson@uwe.ac.uk) and Dr Emma Weitkamp (emma.weitkamp@uwe.ac.uk).

Participant Information and Consent Form for Visitors

Eden Project Research Visitor Information

I'm interviewing visitors as part of my PhD at UWE Bristol. I would like to interview you to understand what going around the exhibition was like for you. In six months I would like to contact you to interview you again over the phone, at a time that is convenient for you.

All information about you will be kept confidential and stored securely. Your name and contact details will not be shared with anyone else and will be deleted at the end of the project. You might be quoted using a pseudonym and your photograph might be shown when telling other people about the research and the results e.g. in written reports, publications, presentations etc. If you agree, I will archive your data so it can be used by researchers in the future.

It is your choice to take part. If you change your mind, let me know within 28 days and your data will be destroyed. Please let me know if you have any questions or concerns, and take this sheet with you so you can refer to it in future.

Thank you,

David Judge

I can be contacted via email at:

david.judge@uwe.ac.uk

If you have further questions, you can also contact my supervisors:

Clare Wilkinson – clare.wilkinson@uwe.ac.uk

Emma Weitkamp – emma.weitkamp@uwe.ac.uk

Eden Project Visitor Consent Form

Deciding to take part	Yes	No
I have been given enough information to make a decision about taking part and have had the opportunity to ask questions.	☐	☐
I agree to being interviewed and audio recorded.	☐	☐
I agree to being contacted in about 6 months for a telephone interview.	☐	☐
Using your information		
I agree to let the researcher have the copyright of any photographs I have taken, so they can be used in the research.	☐	☐
I agree to be quoted under a pseudonym in relation to the research.	☐	☐
I agree that the photographs I have taken, which could include photographs of me, can be shown in relation to the research.	☐	☐
Using your information in the future		
I agree that my data can be archived so authenticated researchers will be able to use it for research or training in the future.	☐	☐

Name: Date:

Signature:

✂----------

Please complete the following contact details so I can contact you for a telephone interview. Your contact details will not be shared with anyone else.

Email address:

Telephone number:

Office use only

PN:

Please complete the following demographic details. This information will be used to make sure I interview a range of different people about their experiences.

Age (please circle):

16-19

20-24

25-29

30-34

35-39

40-44

45-49

50-54

55-59

60-64

65-69

70+

Gender: _____

Occupation (or former occupation if retired):

_____

What is the highest level of qualification that you have?

_____

Office use only

PN: