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Shifting sands: The rhythms and temporalities of island sandscapes

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ABSTRACT

This article explores the different timescales and temporalities of the movement of sand. In recent years, growing scholarly attention has focused on the qualities of sand and the increasing demands for its use worldwide. However, the dynamics of this complex substance and the ways in which it flows through entangled human and non-human environments remains largely under-explored. In drawing on recently collected empirical data, this article explores the speed, pace and cadence of the passage of sand in, around and beyond a small island in the Maldives. It argues for the need to adopt a more substantive comprehension of the choreography of sand as a place-making process that occurs across different, interconnected temporalities, and seeks to explore the emotional and sensory reactions that shifting sand provokes. These temporal dynamics have profound implications for how we understand islands in the context of global environmental change. The article takes the reader on a walk across the island landscape to reveal the mutually interlocking roles that human and non-human agents play in transforming its form, thereby creating an ever-changing sense of place.

1. Introduction

‘What is it about the idea that within its minuteness a grain of sand encapsulates greater things, that it is a metaphor for a grander scale, that it has a story to tell?’ (Welland, 2009: 2)

This article narrates the multiple temporalities and rhythms of the movement of sand. By exploring the diverse ways in which sand flows in, around and beyond a small island in the Maldives, we investigate how human and non-human agents are entangled in shaping the pace, form, extent and direction of flow. We examine how these entanglements alter where sand moves from and to, where it accumulates and where it flows out to sea and the different and changing temporalities of these passages. For sand is ceaselessly shifting through the action of tides, dredging, wind, rain, mining and raking. Sand is collected, manipulated and rearranged daily to reproduce pristine beachscapes for tourists in search of idyllic islands; copious quantities are rapidly pumped to replace beaches lost through sand erosion; and sand bags are filled and piled up to prevent further movement, or to change the direction of its flow. More indirectly, the building of a harbour has altered the flow of the sea around the island and sand no longer circles it but is swept out to sea or into the lagoon. This article shows how these different temporalities, of speed, pace and cadence, and timescales combine to generate intertwining rhythms through which sandscapes

endlessly shift and, in so doing, create a sense of islandness (Vannini and Taggart, 2012).

Sand, as a part of the physical environment, is often walked on, played with, and touched, but rarely do we focus our gaze to observe the ways in which it moves, rests and takes shape around us. It is when sand is scrutinised that its unique and remarkable characteristics become apparent. Sand has multiple forms and states. There are different types of sand, such as silica, gypsum and calcium carbonate-based sand, each with their own degrees of granularity, roughness, consistency and absorbency. Sometimes sand exists in a suspended form in water or air, and at other times is compacted, either through human activities or longer-term geological processes, such as during the formation of sandstone. Sand is often on the move, but it can also come to rest, accumulating to form underwater features in sea beds or above water to create islands. Sand also changes its material form, such as when it is mixed with other materials to produce cement or glass, or when it is exposed to intense heat and pressure deep in the Earth.

Sand connects people, places and things spatially and temporally. As a substance, it is made up of countless tiny grains. However, even the smallest of things can build up to produce something far bigger, revealing linkages and networks between distant places (Woodward, 2005). Thus, as Brigstocke and Jones write, “sand transgresses borders and thresholds. It connects the elemental to the global, and the distant

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past to the present”.¹ In addition, sand has the power to shape the physical and social world through its interactions with human and other non-human agents. For example, prolonged sandstorms in urban areas can have profound effects on daily city life, grounding planes at airports, causing traffic accidents, and preventing people from venturing outside their homes (BBC, 2015). In the study of sand, therefore, the focus must necessarily be on “process and performance and acknowledging the role of the nonhuman in mutually transforming relations in the production of space and experience” (Forsyth, 2016:798).

The multiple forms, uses and qualities of sand give it special significance to people. It plays a critical role in the global industrial economy where it is used in large quantities in the construction and manufacturing sectors. Recently, rapidly accelerating demand for sand worldwide has resulted in increased competition and conflict over access to it (Handron, 2010). Sand is also militarily significant. For example, Forsyth (2014: 249) highlights the role of sand in aiding attempts at camouflage in the desert during military operations in the Second World War. She shows how, in an environment in which “wind and sand are actors and dancers, with everything else the backdrop”, the granular surface of sand acted “as a catalyst for the shift in camouflage from defensive concealment to offensive display”. Sand also has aesthetic and sensory qualities. It is a cultural product for tourism and beach holidays, and has close associations with recreation, such as when building sandcastles or playing in a sandpit. Importantly, sand is a key metaphor for the passage of time, which stems from its use in hourglasses, and is commonly invoked to represent the ephemerality of human existence, as in grains of sand running between one’s fingers.

In islands, localities where multiple forms of agency encounter and intersect, sand, with its multifarious movements and forms of stillness, haunts and enlivens the environment, the economy and society. In addressing how sand moves and comes to rest in a Maldivian island, this article aims to make three key contributions to debates about sand, time and temporality and, environmental change and society-nature relations more widely. First, we note that much work on sand to date has emphasised its economic demands and uses, focusing on human interventions such as sand mining, extraction and land reclamation. In addition to these human dimensions, we are interested in how non-human agents, including sea, air, animals and plants, shape the temporality and spatiality of the movement of sand: how it moves, where it goes and when.

Second, we are interested in observing sand as part of the landscape, but also in exploring how sand is “felt, sensed, apprehended emotionally” (Brace and Geoghegan, 2010:284). Sandscapes have sociocultural dimensions, being ascribed with a range of meanings, and being associated with numerous multisensory and emotional responses. Thus, rather than separating out the cultural and the material, it is necessary to consider how these dimensions of sand intertwine and how such entanglements co-create a unique sense of place and of islandness. Adopting such a perspective involves the consideration of multiple agents, processes, relations and effects in a single location, with its own distinctive characteristics, over time.

Third, we acknowledge how different disciplinary approaches to the understanding of sand, such as those grounded in geomorphology, ecology, and economic and socio-cultural studies, adopt their own temporal framings and perspectives. In considering how sand is formed, moved and stilled in one island place, our aim is to bring these different timeframes together, and to demonstrate how the performance of sand in island-making is conjointly constituted through these. We therefore take seriously “the temporal foundations of matter and culture” and how time is a dynamic force in framing matter and life (Grosz, 1999:3). These processes mean that the very size and shape of islands are constantly changing and that they, along with atolls and sandbanks, can

appear and disappear on a daily, seasonal, cyclical or even more permanent basis.

It is the special qualities of sand that enables this exploration of the temporalities and rhythms of everyday environmental change. As an innumerable aggregation of small grains that collectively comprise swathes of granular matter, sand is a key constituent of the material world. We contend that by exploring how sand perpetually shifts, we are able to offer a unique perspective through which to comprehend the daily, situated and often minute forms of environmental change that are taking place. The ceaseless movement, accumulation and circulation of sand offers the potential to generate understandings of interconnected temporalities in place, and the ways in which these are produced by entanglements with people, weather and diverse non-human agencies. As such, this paper significantly contributes to emerging geographies of sand and specifically reveals the complex relationalities that generate processes of environmental change at multiple temporal scales.

The rest of this paper is structured as follows. The next section explores different understandings of the temporalities of sand: the way it forms, moves and comes to rest, and what these processes mean for the entanglement of different human and non-human agents. Section 3 presents the context of the Maldives and the research methods used to gather the empirical material. In Section 4, the dynamic, ever-changing environment of a Maldivian island is portrayed through narrating a ‘sandscape walk’ around the island. Walking through the island sandscape we show how the material qualities of sand requires and facilitates this narration as its fluidity reveals the island as a place that is always becoming. The narration further highlights how sand creates the distinctiveness of the island, one with its own identity, community and memories. The article concludes in Section 5 by suggesting that islands are always being made and unmade through human and non-human activities, and via the production, movement, stillness and performance of sand. Thus, we argue for a greater sensibility towards, and understanding of, the movement of sand and its role in place-making. In this way, the fundamentally temporal nature of environmental change, and the ways in which it is instigated and felt by human and non-human agents, is revealed.

2. Temporalities of sand: formation, movement and stillness

In marine environments, characterised by fluidity, flux and flow (Steinberg and Peters, 2015), there are many different temporal lenses with which to understand the production and movement of sand. These include perspectives grounded in geomorphology, ecology, climate change, marine and coastal geographies, and economic and socio-cultural approaches. In this section, we explore the different temporal frames and epistemological stances that these approaches use, and how they relate to one another in place-making processes in the context of a tropical island environment.

Sand is a naturally occurring granular material composed of finely divided rock and mineral particles. The most common type of sand is silica, which is mostly found in inland continental and non-tropical areas. In tropical regions, sand is mainly constituted by calcium carbonate, which has been created, over the past half a billion years, by various forms of life, such as coral and shellfish. Additionally, parrotfish generate more than 85% of the new sand sediment produced on outer reef flats each year (Perry et al., 2015). Thus, while temperate beaches mostly rely on sediment input from terrestrial sources, such as rivers and eroding cliffs, coral sand beaches rely on biogenic systems such as coral senescence, coral grazing and excretion for sand production (Mead et al., 2015). For these systems to function optimally, and produce a steady supply of sand, requires healthy reef and lagoon ecosystems.

In geomorphological ‘deep time’, islands and sand in tropical ocean regions can be formed by the creation of atolls, which take up to 30 million years to come into being (Terry and Goff, 2012). Superimposed on this deep time backdrop is a multitude of faster physical cycles and

¹ IBG 2018 Abstract, ‘Harena: Sand, Suspension, and Aesthetics’ (Julian Brigstocke and Victoria Jones).

processes. Sand moves with the waves, currents and tides that continuously wash it onto and off the shore, its' direction, form and extent dependent on the seasons and prevailing weather conditions. Changes, for example, between the dry season and the monsoons are evident as parts of the coastline become submerged or uncovered. In a study of coastal erosion in the UK, Phillips (2008) demonstrated the importance of water level, wind and waves on relatively short-term morphological changes, such as beach erosion. Other scientists remind us that there are local variations and influences in coastal structure and beach erosion related to geomorphology and alongshore sediment transport (Romine et al., 2016). In addition to these ongoing or cyclical (hourly, tidal, daily, seasonal) changes and rhythms, there can also occur exceptional and sometimes violent movements of sand through, for example, tsunamis and storm surges, which can shift tonnes of sand in a very short period, creating or removing a whole beach in a moment (Puotinen et al., 2016). These changes affect beach topography and thus, reef islands continually adjust their size, shape, and position in response to variations in boundary conditions, including storms, sediment supply, tsunamis and sea level (Kench et al., 2018).

Ecologically, islands are teeming with biological life, much of which is intimately connected to the creation and movement of sand, and has its own temporalities, cycles and rhythms. On sandy beaches, the daily coming and going of the tide creates a unique habitat. In the intertidal zone, ghost crabs dig and inhabit deep burrows, periodically shifting sand upwards onto the beach surface and lugworms, which live in u-shaped warrens beneath the beach surface, continually soften and loosen the surrounding sand. Wading birds similarly drive their long beaks into the beach in search of worms, displacing small amounts of sand in the process. Sand also provides a habitat to countless numbers of microorganisms. For example, each grain of sand is inhabited by thousands of different species of bacteria. These tiny but ubiquitous animals interact with seawater, ceaselessly processing carbon and nitrogen-based compounds from fluvial inflows, thus essentially acting as a purifying filter. As well as fauna, plant life helps to structure and stabilise islands and sand where it is able to gain a foothold. In the lagoon, beds of sea grasses develop, their leaves and roots capturing sand, shells, and silt particles. And above the high tide line but before the beach crest, creeping sand-binders extend their tendrils across the ground.

The above physical and ecological processes are continual but are also regularly interrupted, transformed through on-going, periodic or exceptional human and non-human interferences. Climate change, for example, has itself progressed at different rates in the past, altering relatively rapidly in the past 250 years and during ice ages, and changing more slowly during other periods. Moreover, there is evidence to demonstrate that present-day, anthropogenic climate change might accelerate in the future, for example through the 'runaway greenhouse' effect (Goldblatti and Watson, 2012). Although the impacts of climate change on islands are anticipated to be diverse, much concern is about coastlines and the movement of sand in and around these. Indeed, the IPCC (2014) states that climate change can affect the speed with which sand moves and the direction in which it travels due to, for example, increased wave height, higher storm surges, and changes in wave direction.

Climate change discourse is largely future-oriented, but one that is also understood by people living in anticipation of it, "with reference to pasts and presents, remembered and lived" (Fincher et al., 2014;201). In recent years, scholars have identified a rising sense of impending crisis and a general foreboding (Brigstocke (2016) in relation to climate change, one that is summarised by Swyngedouw (2010) as the 'climate apocalypse' imaginary that has become common in popular discourse in the West, especially in the media (Doulton and Brown, 2009). In this future, countries such as the Maldives inevitably face the sinking or drowning of their islands due to time compression, as the erosion of coastlines and beaches is accelerated, and sand is washed away with ever-increasing speed.

Perhaps the most significant human influence affecting coastal spaces in recent years, has been the marketisation of sand and its perception as "cheap nature" (Moore, 2016). Sand has become a new tradeable resource that is being subject to uncontrolled extraction, and is being bought, sold and transported on an unprecedented scale and speed, building networks of people, materials and environments along the way. As a result, whole landscapes are being rapidly reshaped, as sand creates new resource frontiers and fuels territorial expansion.² Additionally, sand mining is a significant source of pollution, contaminating river and marine systems with high levels of sulphate, iron and toxic heavy metals (Saviour, 2012).

These developments in the uses of sand, and the subsequent tensions and conflicts that arise, have led to what Handron (2010) has referred to as 'sand wars'. To illustrate, the Singaporean government has been stimulating massive regional demand for sand for its large-scale land reclamation and construction projects. Subsequently, neighbouring countries, such as Malaysia, Indonesia and Cambodia, have illegalised sand exports to Singapore but have also been subject to "night-time raids on [their] picturesque sandy beaches... carving out millions of tons of coastline and leading to fears of an imminent environmental catastrophe on a swath of tropical islands" (Henderson, 2010). The case of Singapore demonstrates how two different temporalities of sand, one based on geomorphology and the other on economics, combine to produce an outcome that is seen as unsustainable. The extraction of sand is occurring at a rate far greater than its renewal, threatening to produce a new "looming tragedy of the sand commons" (Torres et al., 2017).

In addition to sand extraction, another economic use for sand is in the tourist industry. Tropical islands are popular tourist destinations, and white, sandy beaches play a key role in attracting tourists. Kothari and Arnall (2017), in their work on tourism and environmental change in the Maldives, demonstrate how sand is constantly being moved and manipulated by resorts as they aim to create the types of idealised 'natural' environments that tourists expect. Many of these activities to manage the physical environment are hidden from the tourist gaze. For example, sweeping of the beaches to clear debris and pumping of sand to create long stretches of beach takes place early in the morning before many tourists have risen. At the same time, and in contrast to these interventions and dynamics, notions of constancy, permanence and timelessness in the physical environment are key ways in which tropical islands are marketed internationally and these activities portray a static depiction of beauty that has an ahistoricising effect on local environments (Osagie and Buzinde, 2011). In these ways, the ephemerality (Jackson, 2015) of sand-based environments is downplayed in the tourist island imaginary, much in the same way that "tenacious representations of non-western tourist sites include the myth of the 'unchanging and timeless' culture of places" (Kothari, 2015;5).

The formation of sand is a process that occurs over millions of years, and yet it is continuously forming, eroding and moving. More recently, the production and movement of sand has been shaped by the entanglement of human and non-human processes. Fletcher and Smith (2007) emphasise the need to understand this on-going interplay of the physical and human influences that characterise the coast, "the space occupied by the transition between land and sea" (421), considering the intertwining of land and seascapes in the recent past and the present day. They write that the "physical character of coastal space arises primarily from the geological, geomorphological, and ecological contexts in combination with prevailing atmospheric and marine processes; whereas the human character of coastal space results from successive phases of technological, economic, social, and political development". It is the interaction of these that "creates the heterogeneity of coastal space and supports the claim of uniqueness for all coasts" (Fletcher and

² IBG 2018 abstract: 'Sand grabbing: Cambodia's new resource frontier' (Laura Schoenberger and Melissa Marschke).

Smith, 2007;421). As such, coastlines represent areas where divergent epistemological traditions meet and collide, such as the application of positivist science for utilitarian ends with more grounded understandings of environmental change that are based on lived experience (Jenkins, 2018) and, by extension, we argue, create a unique sense of place for each island. It is the characteristics and combinations of these interconnections that produce multiple and ever-changing temporalities of the movement of sand. In the rest of this paper we illustrate these temporalities in the context of a single island in the Maldives.

3. Exploring shifting sands in the Maldives

The Maldives is an archipelago of 1200 islands grouped into 26 atolls in the Indian Ocean. The country has a population of around 450,000 people dispersed across 188 islands. It is world-famous for its coral atolls and sandy beaches that attract large numbers of high-paying tourists to its luxury island resorts. The first tourists arrived in 1972, and in 2017 there were a total of 1.3 million visitors to the country, an eight percent increase compared to 2016.³ The Maldives is also well known as a country whose existence is endangered by climate change, especially sea level rise, which threatens to inundate its low-lying islands, thus triggering an exodus of 'environmental refugees' (Stojanov et al., 2017). This problem has led to the Maldives being referred to as the 'canary in the coalmine' of climate change (Hirsch, 2015), and has arguably become one of the main forces driving the development of contemporary Maldivian 'nation-ness' (Malatesta and di Friedberg, 2017).

Tourism and the threat of climate change have given the Maldives a high international profile, albeit for very different reasons. What is less well-known, however, is that the Maldives faces a series of domestic political and economic and environmental challenges. In 2017–18, political unrest in the country's capital, Malé, saw the imposition of emergency powers by the government, which has itself been accused of adopting an increasingly anti-democratic stance (Debattista, 2017). Economically, the country's high level of dependence on international tourism makes it vulnerable to fluctuations in the global economy, as well as to the changing demographics and tastes of holidaymakers (Naylor, 2015). And, significantly, the tourist industry is extremely dependent on the maintenance of an idealised tropical island landscape, a touristic imaginary laden with expectations of coastal environments replete with pristine beaches and clear water lagoons.

In 2008, the government introduced a policy allowing the development of guesthouses in island-based communities and the marketisation of these to international tourists. This shift in policy was based on protestations from local islanders that they were not benefiting from the tourist industry. In general, therefore, there is much enthusiasm for these new establishments as they bring economic growth to inhabited islands. However, the mingling of tourists with local populations has raised concerns around disrupting local sociocultural sensitivities and behavioural norms, particularly with regard to western 'hedonistic' lifestyles and scant beachwear (Shakeela and Weaver, 2018). And, in relation to the environment, there are anxieties about the impacts of rapid tourism development on local habitats, such as coral reefs (Cowburn et al., 2018), and the growing quantities of waste, particularly plastic, that are being discarded on a daily basis. Moreover, growing numbers of tourists in resorts and guesthouses means more competition over the use of environmental resources, such as highly-contested 'surf breaks' where surfers congregate (Buckley et al., 2017).

The island where the empirical data for this paper was collected is in north Malé atoll. It is about 1 km in length and 250 m in width and has a population of around 1200 people. To the east of the island lies a barrier reef, which stretches some 500 m towards the open ocean. On the west, facing the interior of the atoll is the lagoon, which is

approximately 2 kms across. To the north and south of the island, where the lagoon meets the reef, are resort islands less than 500 m away. The original island jetty was in the deeper lagoon on the west, whereas the new harbour has been constructed on top of the reef on the east, and a channel has been cut through it to provide access. Sand is now being lost from the lagoon and is either being washed out to sea or is accumulating on the reef to the east, whereas before it used to circulate more freely.

In the past, islanders' livelihoods had been predominantly based on tuna fishing or employment in the nearby international resorts. However, since the early 2010s, the number of guesthouses on the island has grown rapidly, and there are now 11 such establishments, with more being planned. These developments have brought about a range of economic benefits but also sociocultural and environmental concerns amongst the local population, as outlined above. In response, the Island Council is attempting to implement a land-zoning plan to distinguish between areas designated for residential use and those assigned for tourism and related activities.

Data collection on the island took place over a one-year period, from October 2017 to October 2018. During this time, a total of 71 interviews were undertaken with residents. We adopted the 'go-along' research method (Kusenbach, 2003) to record and observe people's everyday lives and connections with their environment while they actively inhabited their social and physical contexts. A purposive sampling strategy was used to seek out information-rich sources and stories (Jackson, 2001). However, views from a wide range of stakeholders were sought, including island council leaders, guesthouse owners and managers, shopkeepers and fisherfolk, so that a variety of ideas and opinions would be gained. Discussion topics during interviews varied but mostly centred on understanding the main changes to the island over time, and what these changes meant in terms of how people saw their lives and those of their families and communities in the future. Most interviews were conducted in Dhivehi and later translated into English; some were recorded and then transcribed whereas others were conducted in a more informal manner and later written up in a field diary. During the fieldwork, the ethical guidelines of the authors' home institutions were adhered at all times, and the standard procedures and practices were followed in the Maldives to gain access to communities. To protect islanders' anonymity, the names ascribed to quotes and comments in the sections that follow are not the real names of the individuals and we have avoided referring to the island by name or providing a map.

The study of multiple temporalities, actors and scales in a single place inevitably raises several challenges with regard to presenting the empirical research. We were keen to avoid the imposition of any supposedly 'natural medium in which matter and life are framed' (Grosz, 1999;3). Rather, we were interested in letting the multiple temporalities of sand emerge as we accompanied residents as they moved through their island. For this reason, the next section is based on a 'sandscape walk' around the periphery and interior of the island.

We fashion a circular narrative of the walk to explore the different rhythms and movements of sand as they are encountered in place, starting and finishing in the same location: the island's most northerly point where the daily ferry from Malé enters and exits the harbour. While we do not 'see narrative and analysis as discrete projects' (McDonald, 2014; 478), the analytical themes that arise from the sandwalk are addressed in a subsequent section so as not to disrupt the narrative flow. Furthermore, we follow Wylie (2005) in his telling the story of a single day's walking so as to enable 'the possibilities of deploying a fragmentary and narrational rather than thematic or schematic structure' (2005: 235) and to allow 'for contrast and progression to emerge' (ibid: 245). However, we also depart from Wylie's approach because the sandwalk did not take place over a single day and, accordingly, we have produced a narrative composed out of multiple stories over time in order to engage with the endlessly changing island sandscapes. This consequently entailed walking with others. Scholarly

³ Maldives Ministry of Tourism, Monthly Updates website.

exploration of walking has become increasingly popular (Edensor and Andrews, Forthcoming; Lorimer, 2011). While walking is often part of unreflexive mundane routines where habitual fixtures are barely noticed, walking can also attune us to the distinct qualities of the landscapes we pass through. This attunement may be heightened through walking collectively and sharing embodied ‘experiences of movement, rhythm, pace and direction’ (Brown, 2012; 811), animating connections made with the landscape (Gabrys, 2012; Lund, 2012). In order to maximise these opportunities, we walked with local islanders while asking questions to encourage a reflexive re-attunement with their familiar environments. Such shared reflections included animated discussion about the stillness and movement of sand, underlining how the island is always emergent, continuously recomposed by human and non-human agents. Indeed, using walking as a research method revealed how the walk was ‘made distinctive and meaningful by the physical features and material textures of place’ (Lorimer, 2011: 20) and we thus actively participated in processes of place-making.

4. Moving through an island Sandscape

Approaching the island, the boat first passes east through the lagoon, before swinging south east to navigate the channel cut into the reef that provides access to the harbour. The lagoon, reef and island were formed millions of years ago. Like all atolls in the Maldives, its creation began with a seamount, an underwater mountain caused by volcanic activity, which eventually rose above the surface of the ocean. Over millennia, this volcano became extinct, and corals began to develop around the island, forming what is known as a fringing reef, growing directly outwards from the shore. The dormant volcano then began to sink, weighed down by the heavy reef and rock on top of it, or due to underwater tectonic plate activity. As the island sunk, the corals remained, growing upwards towards the sunlight. Eventually, a wide band of water, the lagoon, formed between the reef and the island. As the corals broke the surface of the water, they died, and their stony skeletons turned into sand, mixed with shells and algae. As the coral reef emerged from the ocean, it became colonised by vegetation, eventually forming a terrestrial tropical habitat capable of sustaining a wide variety of life.

This process of island and sand formation is an example of an ancient and imperceptibly slow geomorphological transformation, one that is hard to comprehend as now the boat pulls into the harbour and comes to rest alongside the quay wall. What is more discernible, however, is how, in the past thirty years, the shape and physical environment of the island has changed considerably, in ‘quick time’, through an entanglement of human and non-human processes. These alterations have impacted on where sand is removed from, accumulates and comes to rest. One of the most impactful influences has been the creation of the harbour, which lies on the north-eastern side of the island, and the reclamation of land adjacent to it (see Fig. 1). The harbour was originally built on top of the reef in 1995, and then rebuilt following damage caused by the 2004 tsunami, to provide a deep-water entry point for fishing and ferry boats. It replaced a smaller jetty located on the west side of the island in the lagoon. Creation of the harbour began with the rapid shifting of large quantities of sand off the reef to make way for the new structure and to allow the entry of deep-water boats into it. This was followed by the introduction of enormous amounts of externally-sourced sand for concrete to create the harbour walls. The harbour has brought many benefits. Fisherfolk can now bring their *dhonis*, small fishing boats, to the shore whereas previously they would be grounded during low tide due to the shallowness of the lagoon. However, the harbour has also altered the physical and social geographies of the island, bringing with it a new sense of islandness. For example, the area where the harbour was constructed used to be a beach where islanders would picnic and swim. Nowadays, it is a hive of different activities, with fisherfolk on makeshift platforms and dinghies line-fishing at dawn and dusk, supply boats unloading their wares and

people waiting for the daily ferry from Malé. Other islanders sit on the row of hammock seats, known as *jolies*, that line the harbour – resting, chatting and watching the goings-on in and around the harbour.

East of the harbour lies a large, rectangular area of reclaimed land, about 38,000 m² in area. There is some ambivalence amongst island residents concerning the social and environmental impacts of this ‘new’ land. It was created through the large scale, rapid and noisy pumping of large quantities of sand from the lagoon. Once on the shoreline, the sand was stabilised and compacted, thus increasing the surface area of the island and creating new land suitable for housing and infrastructure. A boat yard, now littered with discarded fishing boats and those in need of repair, was built on a section of this reclaimed land. Before the land was reclaimed there was a small sandbank in this area of reef, and elderly residents reminisced about going swimming there as children. One complained that her house used to be close to the shore but was now set back from it following the reclamation (Aminath). This meant that the view from her front door was less aesthetically attractive and that she now had to walk across the road to fish and to swim. This repositioning of people’s homes and the noticeable loss of vegetation cover on the shoreline is evident in the recollections of an elderly islander who said, ‘back then, before the land was reclaimed, waves would break where we are sitting now, this was the sea’ (Niuma). This recollection, that brings together the ‘old and slow’ with the ‘new and quick’, reveals that the movement of sand is central to how people narrate environmental change.

Walking along the east coast of the island, away from the harbour, the full breadth of the ancient, 500-metre barrier reef comes into view. On this section, the whirr of a sand pump can be heard, above the roar of the ceaseless crashing of waves against the distant fringes of the reef. Here there is an attempt to build a beach. The pump sits on top of a wooden raft, positioned some 30 m into the reef. The powerful machine sucks up sand and seawater and forces it down a pipe, from which it sprays onto the shoreline. It is operated by the island’s main guesthouse largely to meet tourists’ expectations of a wide sandy beach. As the guest house manager confirmed, ‘without the beach, we have no tourists’ (Ali). The rapidity and forcefulness with which this process of sand removal and accumulation takes place contrasts sharply with the sense of naturalness and permanence in the landscape that tourists experience once the pumping machine and raft have departed from the lagoon. In this section of the island, sand is being used to recreate and sustain a touristic sense of environmental time (see Fig. 2).

Away from the reclaimed land, the island begins to narrow into a long, thin sand spit, which projects southwest, following the line of the atoll’s barrier reef. Moving along the spit, its setting is clearly very different to that of the reclaimed area. Whereas, to the north, much of the coastal sand is ordered, settled, compacted and protected by sea-walls, here on the spit it is exposed to ocean currents, wind and rain. In the monsoon season, a strong wind moves continually from east to west, dislodging and blowing sand with it, sending it hissing across the vegetation. The activities of ghost crabs are also evident from their numerous burrows in the intertidal and supratidal zones of the beach, from which they emerge at night to scavenge for food. Ghost crabs are common in this area as the relative absence of people means that the sand is less compacted by human activity and therefore more suitable for digging by the small vertebrate. In their minute, slow way these crabs manipulate sand collecting it from up to one meter below the surface of the beach and churning it up to deposit small piles above the surface. Here, the sand is more exposed to the wind, waves, tide and currents and so more likely to be blown or washed away. In contrast to the harbour and reclaimed section of the island, the sandspit represents a zone where non-human agents dominate the movement of sand. This results in a more dynamic and unpredictable environment than one in which human intervention has resulted in the shifting and stilling of sand on a large scale (see Fig. 3).

The end of the spit narrows to a point, but it is often difficult to discern where the land ends and the sea begins. There are four



Fig. 1. The Island's harbour.

sandbanks off this side of the island, but these appear and disappear with the movement of the tides. Thus, it is not only the sea that moves and changes shape; the land is also not static. At certain times of the day, the sand spit connects with the smaller, shallower sandbanks, creating a sand causeway between the inhabited island and the neighbouring resort island to the southwest. Concerned that locals will walk back and forth across this structure, spoiling the isolated imaginary that they are producing for tourists and fearful that islanders will steal from the resort, the resort has placed a large sign barring them from crossing. At other times, the sandbanks are under water and the island and the resort are once again disconnected. This process of attachment and severance incessantly modifies the outline, shape and form of the island and enables or proscribes human movement, shifting the possibilities of mobility and access. Where then are the island's borders and how does this delimit what geographically,

environmentally and culturally constitutes an island? The frequency and speed of the daily appearance and disappearance of the causeway varies according to the seasons: vanishing more rapidly during the rainy season and reappearing more frequently during the dry season. The movement of sand in this area thus provides an example of the multiple temporalities of physical and marine geography: a place where tides, currents, wind and rain come together to create an ever-changing area of land-water.

Further around the spit, on the western side of the island, the beach narrows considerably. This is an area where rapid coastal erosion is taking place, as evidenced by the exposure of the tangled root systems of palm trees that once provided protection from the loss of sand. Islanders confirm that 'this side is now completely depleted due to erosion' (Ahmed). This is the side of the island to which local islanders had retreated, their own erstwhile beach having been apportioned to



Fig. 2. Sand pumping for beach renovation.



Fig. 3. The island's sandspit.

tourists. And here too, as on the eastern side, homes have been repositioned in relation to the sea. Yet this time the space between the homes and the sea has become condensed and dwellers find themselves living ever closer to the shore, causing concerns that their homes will become destabilised and eventually collapse into the lagoon. One homeowner said, 'our land is being eroded, our house used to be located inland but now it is right next to the sea' (Mohamed). Another recalled, 'there was a large wooded area beyond the school and enough space for two rows of houses to the west of the football field. But now there are only a few coconut palms in between the field and the beach as the whole area has been washed away' (Hawwa). For islanders directly affected by coastal erosion, the loss of the beach in this way confronts their belief that the island provides a home, their sense of stability confounded in the face of an ocean that is constantly encroaching.

Although sand has always been displaced from this side of the island, more significant movements were noticed by islanders following the building of the harbour and the reclamation of land on the north-eastern side. This is because the sand, rather than flowing around the island, is now deflected into the open ocean. Previously, erosion on the island's western side was attributed to mining sand from the island beaches. However, as Ibrahim explained, 'it has been around 30 years since that practice stopped, but erosion continues. The white buoys that you can see far out in the lagoon used to be where land was. I am convinced that the erosion is due to the movement of sand being blocked by the building of the harbour'. In addition, one resident explained that, when the main arrival and departure point for boats was located on the western side of the island, 'there was a *mundaan*, large coconut trunks pegged into the sea to tie ropes from the boats. This former jetty area has now been eroded because the coconut trunks have been removed and there is no protection to prevent sand erosion' (Shifa). Others are anxious that this erosion might have far reaching effects on the economy and demographics of the island as 'people might eventually simply have to leave the island' (Niuma), rupturing their ties with their islands of origin, if they are unable to relocate to its eastern side.

On this side of the island, measures are being undertaken to try and slow the erosion of sand. Groups of Bangladeshi migrant workers, operating in day and evening shifts, fill sandbags and lay them along the shore to stabilise the coastline and keep the sea at bay, thus adding a further temporal dimension to how sand moves, accumulates and come to rest. Further along are three groynes made of sandbags and cement that project some twenty meters into the lagoon (see Fig. 4). However, there is some disagreement amongst residents over the effects of these. One islander stated, 'when one person builds a groyne, there is erosion

somewhere else – a groyne cannot reverse its position with monsoon changes' (Moosa). Another commented that guesthouses 'are now building groynes in front of their property to hold the sand. This is causing erosion on another part nearby. Recently, the *boashi* tree on the beach fell into the sea due to erosion after a groyne was built by one of the guesthouses' (Fathimath). Despite these problems, others foresee that all the beaches will eventually have to be modified using groynes (Mariyam) given that the process of sand erosion being witnessed on this side of the island will be exacerbated through 'time compression' in the future. The effects of recent, anthropogenic climate change will become more evident due to increased wave action and faster currents, and thus the sand is likely to move at a speedier rate. Moreover, it is anticipated by many residents that what is happening now in this part of the island will be replicated all around the island in the years to come. As such, the future is evident in the present via the movement of sand.

On this section of the island and further inland, there is additional disturbance and compaction of sand taking place. This is due to infra-structural development associated with the recent growth in the local guesthouse industry and to a growing population. For example, sand has been moved and compressed to make thoroughfares and to install the new sewerage system. As one inhabitant said, 'the sewerage project will improve the beaches because the outlet pipes will now be taken to the open ocean and there won't be any outfall directly into the lagoon' (Khadeeja). However, sand is destabilised as it is dug up during the works and thus becomes more vulnerable to the action of wind and rain, even if it is buried again at a later stage. Therefore, even in the interior of the island, sand does not lie for long but is often disturbed through construction-related activities. Additionally, sand and coral excavated from the reef to build the harbour were dumped, forming large, abandoned piles dotted around the island. This excess matter has largely remained where it was tipped. Yet, one islander, Ismail, has made use of the abandoned sand. Following heavy monsoon rains he collects it in his wheel barrow and compacts it over the path around his house that has become too muddy to walk on. This process, of sand being washed away from the road, replaced, and then washed away again, forms an interlocking cycle of removal and renewal that progresses with the changing seasons and the actions of islanders.

Although sand mining from the beach has long ceased, the practice is still being carried out offshore in this part of the lagoon, on the western side of the island, as well as further out to sea towards the centre of the atoll. Although sand mining can provide a good income, the industry has changed significantly in recent years. Abdulla used to collect sand from sandbanks near the island but can no longer find it



Fig. 4. Sandbags to mitigate coastal erosion.

there due to changes in the ocean currents caused by the building of the harbour and land reclamation. He is now compelled to go further afield. Much of this mined sand is used for construction of houses and guesthouses on the island. The variations in building materials of islanders' homes provide evidence of the changing history of the use of island resources, notably sand and coral. While new buildings are made of concrete, lime and clay, mixed with sand and water, older structures were largely made of mined coral. Aishath said her house, built 29 years ago, was made of coral stone that her husband brought from the island reef and lagoon. The recent change in construction materials has led to an increased use of sand. However, its capture and stabilisation as a construction material in buildings effectively takes it 'out of circulation' from the physical environment and human activities, potentially for many decades. In this way, in the walls and floors of houses, sand is stabilised, fixed in space until the house is demolished to make way for a newer construction or is left to be washed away by the encroaching sea.

Walking on to the north side of the island there is a 250-meter gap that separates the island from a nearby resort. The narrow strip of white sand facing the area where the reef meets the lagoon has been officially designated by the local council as the tourist, or 'bikini', beach. The sand in this area is therefore a crucial, lucrative resource for the island's expanding tourism sector. On this strip, tourists can dress as they please, although they are instructed by guesthouse owners to cover up as they walk to and from the beach. Many locals give this area a wide berth. It is sufficiently far from island residents to avoid contact with 'Western tourists' whose attire, it is thought, is inappropriate and unacceptable to the cultural mores of the island.

While tourists often imagine a timeless, unchanging tropical island landscape, residents are all too aware of modifications to the north beach due to the movement of sand. The main issue here is the erosion of sand that is often blamed on the groynes to the south and the building of the harbour. Yet, a further intervention with even greater and more immediate impact is the pumping of sand from the lagoon by the resort on the neighbouring island, which is intent on maintaining its 100-meter-wide beach for its guests. Furthermore, the resort is pumping sand to build up the sand bank closest to it as a designated spa area.

Here, the resort plans to plant trees to block out the 'unsightly' construction work taking place on the inhabited island. The resort's sand dredger and pump just beyond the lagoon between the two islands can now be seen and heard 24 h a day. The local council believes that these interventions by the resort are contributing to erosion of their own beach which is now less than ten meters wide. Guesthouse owners have now come together to organise and fund the replenishment of sand without which there would be no beach. As one resident recalls, previously 'there was so much sand that even the channel and the harbour were too shallow for fishing boats to enter. The Council had to deepen the area twice a year. Now most of this sand has been eroded or extracted' (Leela). Others reflected on how this has affected the aesthetics and beauty of their island. As one resident complained, 'when the sand eroding from this island goes over to the resort, they take it and put it near their spa using pumps. Now this island has no sand, and has no beauty' (Arifa). Another remembers 'the feeling of welcome...when I came to the island in the *dhoni* when I was young, and the beautiful colours of the lagoon. It is not there anymore' (Nizam). These examples illustrate islanders' emotional connections with, and responses to, the island's changing sandscape. The beauty of sand, and how its colours interact with those of sea and sky, forms an important part of people's memories, their nostalgia for past encounters with their island environment and how they think about their futures.

In addition to pumping sand, guesthouse owners have organised the removal of sea grass from the channel between the island and the resort so that tourists can experience the pristine, clear waters that they expect on their tropical island destination. Many residents believe that, because sea grass stabilises sand, its removal has speeded up and exacerbated its loss to the ocean. Others, however, argue that sea grass prevents sand from reaching island beaches in the first place. For example, Yoosuf said that, 'we remove sea grass because if it spreads, sand will not come to the island. The sand goes on top of the sea grass, and the sea grass grows upwards above it and forms new shoots, and shoots above that. Like that, the area will rise. Even now, if we scrape off the sea grass lightly, all the sand would come towards the island. Within 24 h, the sand rolls over and comes to land on the island. The islands with nice beaches are actually islands where there is no sea grass'. Thus,

while sea grass removal is understood to accelerate the movement of sand by the ocean currents, the effects of this on the expansion and retreat of beach boundaries is disputed.

Continuing on from the island's north side, the harbour comes back into view. Here, a flurry of activity is taking place as the ferry from Malé arrives to offload its cargo of people and goods, fisherfolk return with their day's catch, and islanders recline on the public *jolies*. And all the while, sand continues to move and be stilled at varying speeds and scales through a complex entanglement of human and non-human processes.

5. Conclusion: The multiple temporalities, agents and scales of sand

As the landscape walk described above shows, the movement and stillness of sand ceaselessly interact with human actions and non-human elements such as water, wind and the activities of small creatures at multiple times and places on the island (Dixon et al., 2015). On the eastern side, there is the heavily engineered zone, where extensive construction and reclamation has taken place. In this area, human actors have attempted to dominate sand by shifting, stilling and compressing it in very large quantities. In the south, the sandspit forms an area where there is relatively little direct human influence and where non-human forces, most notably wind, rain, currents, vegetation and crabs, shape the movement of sand. This leads to altogether a much more changeable environment in which sand is essentially left 'wild'. The western side of the island, as well as the northern beach, are characterised by accelerated coastal erosion. Here, there is a struggle between the human and non-human taking place, as people attempt to mitigate the effects of non-human processes on the movement of sand by preventing, or at least slowing, its progress along the coastline. Thus, even on a small island, human and non-human interactions with sand varies considerably, illuminating the dynamism and unpredictability of sand environments.

The situated engagement with the island landscape that we provide enables a particular understanding of the interconnected and different temporalities of environmental change. We have tried to avoid imposing a particular, pre-determined temporal framework upon the empirical material, opting instead to allow the multiple and interlinked temporalities and timeframes to emerge as the journey progresses. Indeed, the particular combinations of speed, pace and cadence of the passages of sand in, around and beyond the island are numerous. They include processes that are ongoing, such as the formation of sand grains and their movements by ocean currents, those that are cyclical, for example the shifting of sand from underneath the beach to its surface by crabs, and those that are infrequent and violent, like storm surges, as well as the interactions between all of these. Moreover, many of these movements are, either intentionally or inadvertently, stilled, slowed down, or speeded up by human activities, whether these are mundane and small-scale, such as the daily sweeping of the beach, or exceptional and far-reaching, such as the compaction of tonnes of sand as part of a harbour wall. And processes such as sand excavation produce excess matter such that sand becomes part of a 'superfluous landscape' (Nielsen, 2002) but one that also provides a resource that is used creatively by islanders.

As shown by the island walk, people attach a range of meanings, emotions and sensitivities to the movements or stillness of sand. The narration reveals these aesthetic and affective qualities, as islanders' reminiscences create a place replete with memories evoked by sand's dynamism and fixity. Islanders express a sense of pride or satisfaction over the stabilisation of sand in the walls and floors of new guesthouses, the pleasure that they derive from recalling the colour of beach sand and how it contrasts with the sky and sea, or their concerns over the potential displacement of their houses due to the erosion of sand. These affective dimensions emphasise the importance of considering sand's non-representational qualities in addition to what is produced by sand,

as entangled human and nonhuman practices involving sand are performed or enacted on a daily basis.

These dynamics also reveal the importance of sand in island place-making, complicating what an island is and how a sense of islandness comes about. Sand, a granular material, enables a narration of the island as always becoming. Islandness, then, arises not just from the external gaze of the tourist (Kapstein, 2017), nor the day-to-day movements and activities of its inhabitants (Vannini and Taggart, 2012), but also from the movements of sand and the particular environments this creates. Specifically, the materiality of sand itself, its granularity and fluidity, transforms the look and feel of the island. As such, the incessant movement, accumulation and also the stillness of sand changes the island's nature. Indeed, the sandwalk narrated above reveals how the island is ceaselessly shifting and always becoming, yet with its own distinct identity, community and memory. The approach taken in this paper therefore offers new ways of understanding how islands are constituted. Indeed, the ceaseless movement of sand that changes the form, size and shape of an island challenges prevalent notions of islands as clearly bounded, separate entities. To fully comprehend this process thus necessitates a consideration of the cultural and the material together. Indeed, it requires adopting a greater sensibility towards, and understanding of, the choreography of sand in place-making across different but interconnected temporalities, as well as the range of emotional and sensory reactions that they provoke.

These dynamics have profound implications for how we understand islands in the context of environmental change. As shown above, an island is continuously being made and unmade, through human and non-human activities and processes that interact with the performances of sand. Therefore, there is no specific start or end point to the life of an island; what an island is – how it constitutes the lifeworlds of those living on it – is never complete but is continually under construction (Ingold, 2000). Thus, while people concerned about rising sea-levels, increased erosion, and the intrusion of seawater onto land may attempt to fix the edges of their islands (Yarina and Takemoto, 2017), this downplays the complex, temporally-based dynamics of sand that undergird the notion of a border, as well as the mutually interlocking roles that human and non-human agents play in transforming the size and shape of islands. In the Maldives there are many forces acting on its island landscapes and thus the country's future is not 'pre-determined' by climate change (Hulme, 2011), but rather is one that is constantly in the making in the present. Islands, therefore, are dynamic entities: they are in states of transition as new island forms mingle and react with older ones, changing local identities and meanings in the process. Taken together, these dynamics suggest that we need a far more flexible interpretation of how future environmental change is conceptualised and imagined, how it will unfold, and the consequences that it will have for different individuals and social groups in the Maldives and for those living in island environments more generally. Rather than putting effort into predicting the future as a basis for intervention, greater attention can be directed towards consideration of what kind of places we want to construct in the present. We should also consider how these constructions might be fashioned in an equitable manner through the different temporalities acting upon them, and how they might change in the future taking into account the full range of human and nonhuman factors that shape them.

Sand is always coming to, and moving away from, the island. Indeed, sand connects the island and its human and non-human inhabitants to the wider world, whether this is through the movement of ocean currents or the activities of distant sand markets. Through this situated narration of sand, it is clear that the very nature of sand, its entanglements with people, elements, politics, environments and economics and its more-than-human geographies, allows for a more holistic understanding of how sand shapes the world.

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