SCRIBE: Crowdsourcing Indigenous Knowledge
by
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Submitted to the Program in Media Arts and Sciences, School of Architecture and Planning, in partial fulfillment of the requirements for the degree of
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Abstract:

The Ethnosphere is woven into the matrix of the biosphere as a simultaneous duality, and yet cartographers of disciplinary territories raise boundaries to dis-entangle the dialectic dualities: Nature from culture, scientific knowledge from indigenous knowledge and the form from the formless. The project of modernity with its predilection for organizing knowledge into disciplinary silos served to render the boundary between nature and culture impermeable. Myths, folklore ,language and heritage are animating phenomena for the human experience of mediating matter ,establishing networks that permeate boundaries between life-non life, human- other than human, form and the formless. This research will journey through the overt but out-of-sight ecosystem transformations that are instigated from historically muted indigenous tribes and will develop a method of conservation of indigenous knowledge that is in-situ, espouses a critical conservation approach, engages with the issues of indigenous self representation and offers defensive intellectual property protection. It explores the design of a tool called SCRIBE to crowdsource and document oral histories, ecological memory and indigenous knowledge and practices relating to ecosystem management using new media. The tool can be used to and spatially correlate such media alongside earth observation data and scientific studies on resource conservation emerging from the same geographies. Re-positioning two ontologies: the scientific and indigenous, in juxtaposition with one another, dismantles the false divide between these two categories and presents an opportunity to combine two sets of data sources that are rarely ever combined, and privilege vastly different ways of knowing. In crystallizing process into product and research into a technology that can be used for conservation, the thesis will seek to dwell deeply on devising the methodology of interaction with the communities, on the co-creation of a structure of engagement, of humbling learning from both their knowledge and their ontologies. This will inform the design principles for a tool that can address the complex questions of justice that underly the politics of knowledge conservation.

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It was a wicked cold day in the middle of November. The elder was visiting, his first ever journey to the north east. As soon as we met him at the airport, we asked him what he would like to do on his first visit to Massachusetts and he whispered in a paper thin voice, like the wind rustling through driftwood lost in the desert, that he would like to pay his respects to the Atlantic Ocean. It was a wicked cold day, in November, and he walked right up to the beach, tongues of icy cold water licking the seams of the earth. He walked in upto his waist in water, and took out a fistful of something from his pocket and threw it into the ocean and whispered into the ocean in his gravelly dusty voice, 'Its not much, but where I come from its everything.'

Later I asked him what it was, the thing that he threw into the water. Corn, he said.
It was corn.

This thesis has been an exercise is receiving benediction, and I am grateful for the many hands and many many voices that have guided my gaze, bolstered my spine and drawn out my pen. I am infinitely grateful to Dr. Danielle Wood whose overarching generosity, grace, commitment to justice and expansive vision has offered me a home in academia. To Terry Tempest Williams for magic and courage, to Andre, Nicole and Ariel for being the kind of collaborators that draw the infinity out of you. For all my incredible colleagues at the Space Enabled Group, for the rich and diverse faculty and students at Media Lab. To my readers Professor Galla and Zach Lieberman for carrying this thesis through. I am immensely grateful for the trust heaped upon me by our partners at the Living Root Foundation, without their infinite grace, it is unlikely that I would have a thesis. Along the way, I have met many many people, of the land, who never took their ears off the ground, for the encounter, I am so very grateful. This project would not have been possible without the generous support of the Elements Fellowship, the Human Rights Fellowship, the PKG fellowship and the MISTI fellowship.

To my incredible parents, whose love and wisdom tenderly alights and walks me through the darkest night, to my siblings who are my utter joy and delight, to TT who is nothing short a miracle himself, to my beloved Aaron. Where would I be without you? I am grateful to this weeping, grieving land. For teaching me, slowly, how to become fluent in earth, I am so very grateful.

It is not very much, but where I come from its everything.

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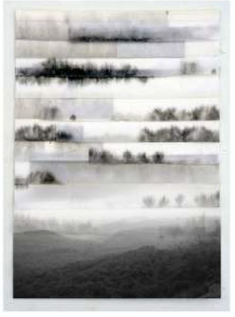

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ABSTRACT

The Ethnosphere[1] is woven into the matrix of the biosphere as a simultaneous duality, and yet cartographers of disciplinary territories raise boundaries to dis-entangle the dialectic dualities: Nature from culture, scientific knowledge from indigenous knowledge and the form from the formless. The project of modernity with its predilection for organizing knowledge into disciplinary silos served to render the boundary between nature and culture impermeable. Myths, folklore ,language and heritage are animating phenomena for the human experience of mediating matter ,establishing networks that permeate boundaries between life-non life, human- other than human, form and the formless. This research will journey through the overt but out-of-sight ecosystem transformations that are instigated from historically muted indigenous tribes and will develop a method of conservation of indigenous knowledge that is in-situ, espouses a critical conservation approach, engages with the issues of indigenous self representation and offers defensive intellectual property protection. It explores the design of a tool called SCRIBE to crowdsource and document oral histories, ecological memory and indigenous knowledge and practices relating to ecosystem management using new media. The tool can be used to and spatially correlate such media alongside earth observation data and scientific studies on resource conservation emerging from the same geographies. Re-positioning two ontologies: the scientific and indigenous, in juxtaposition with one another, dismantles the false divide between these two categories and presents an opportunity to combine two sets of data sources that are rarely ever combined, and privilege vastly different ways of knowing. In crystallizing process into product and research into a technology that can be used for conservation, the thesis will seek to dwell deeply on devising the methodology of interaction with the communities, on the co-creation of a structure of engagement, of humbling learning from both their knowledge and their ontologies. This will inform the design principles for a tool that can address the complex questions of justice that underly the politics of knowledge conservation.

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1 As Defined by Wade Davis as “the sum total of all thoughts and intuitions, myths and beliefs, ideas and inspirations brought into being by the human imagination since the dawn of consciousness,” the ethnosphere is humanity’s greatest legacy

1

INTRODUCTION

The Soligas of the Biligiri Ranga hills are an indigenous tribe living in the Western Ghats of India. With 27 words for rain. Burnt soot rain, rain that kisses the leaf litter but doesn't wet the ground, the rain that makes elephants shiver… The coherence of the Soliga language is inseparable from the coherence of their surrounding ecology. Culture emerges from the expressive vitality of the terrain. For them, their sylvan universe is semiotically laden, the sight of a plant, the migration of the bees, the pregnant elephant are all signs that communicate with them. They practice a rain based ecology in which each type of rain signals the performance of a reciprocal ritual, each type of rain dictates the hunting or harvesting, the consumption or prohibition of a specific diet. This allows the community to fine tune and manage the equilibrium conditions of their constitutive ecology thereby allowing keystone species to thrive. Subject to historic policies of marginalization and dispossession, today they are a diminutive population vulnerable to the machinations of poverty, politics and profiteering.

Fig 1: Is a graphical depiction of the rainbased calender of the Soligas, at the center are the 27 states of rain, each type of rain is radially arrayed next to its constitive forest practice and the forest rituals associated with that specific time.

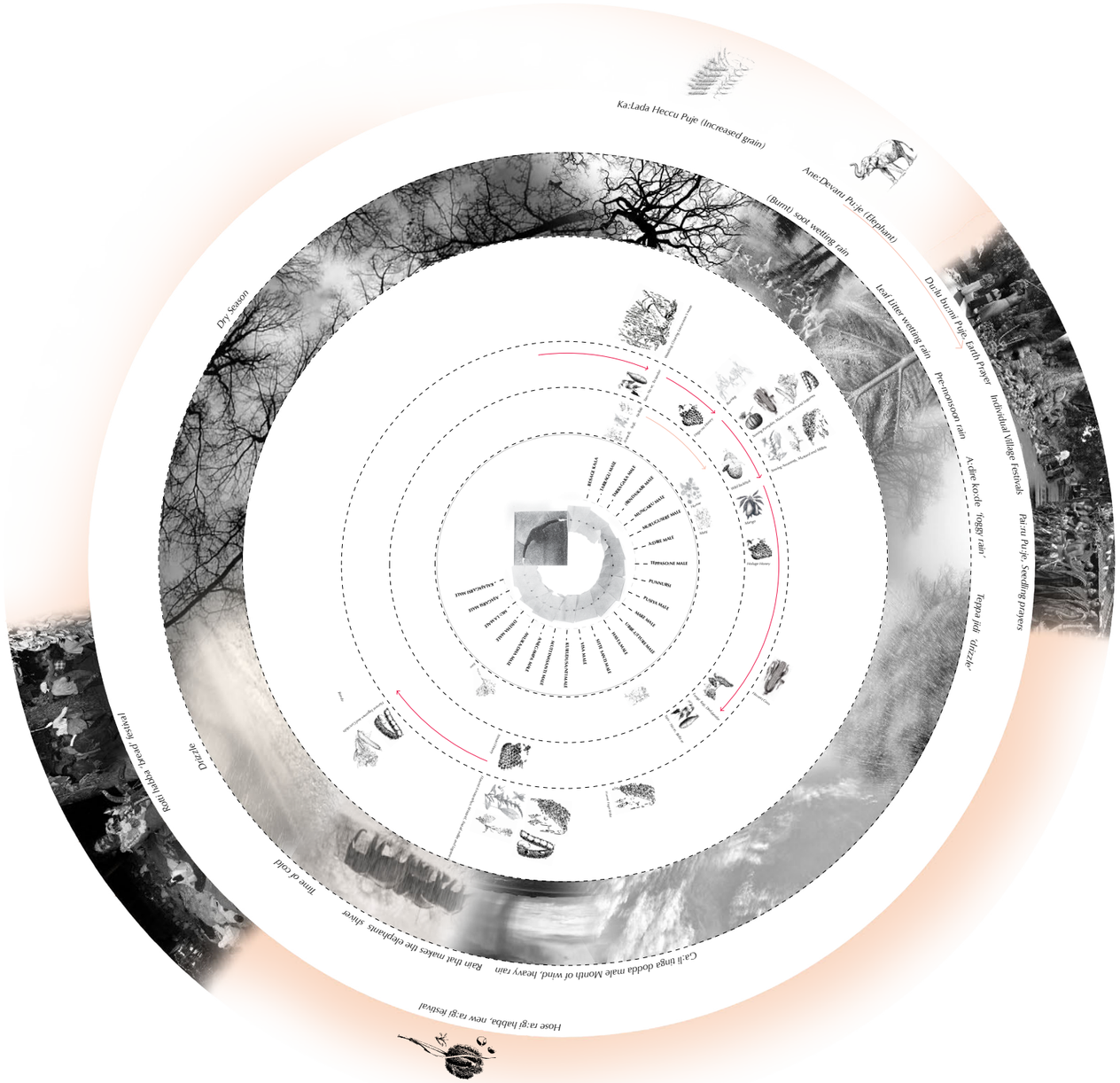

Fig 2: A close up of the rain calender, that the soligas uses as guiding epistimology through which to unfold their forest practice.

Among the Padhars of Jamnagar, in Gujarat, a bare handful of people still remember the old ways, from when their predecessors would peer into the inky depths of their ancestral wells, onto the crusty salt deposits that line the bottom, and through careful observation of the small shifts and cracks on the pattern of the surface, predict with reasonable certainty, imminent earthquakes in the region. For them, the salt deposits register movements of the tectonic plates as discernible patterns, which they then use to foretell natural disasters. There are only 9 people alive who keep this knowledge from passing beyond the veil into oblivion[2].

These two examples illustrate that the ecological crisis[3] on which we are at the precipice is not only a crisis of nature resulting from a loss of biodiversity, but its also a crisis of culture stemming from a poverty of ethno-diversity. Some of the most pristine habitats in the world, areas rich in biodiversity and systems essential to our global climate, fresh water, and food security have historically flourished under the guardianship of indigenous peoples. With more than 400 million self-identified peoples in some 70 countries around the world[4] their traditional lands guard over 80 per cent of the planet's biodiversity. 140 million of these indigenous people live in Indian forests alone. Having evolved rich and ancient cultures in reciprocity with the changing ecology, they are stewards of complex traditional knowledge, ritual and practices of ecosystem management and sustainable subsistence based inhabiting. These cultures epitomize the old growth forests[5] of the mind, cultural ecosystems that are last bastions of diversity in an increasingly homogenizing world and yet indigenous people across the world "are also among the world's most vulnerable, marginalized and disadvantaged groups." It is a cruel paradox that the guardianship of world's most healthiest ecosystems fall to its most vulnerable.

As forces of globalization increasingly demand of varying cosmologies a revision of their cultural architecture into a homogenous ideal, the culture capital invested within indigenous knowledge practices across the earth are under threat of rapid and irrevocable erosion. The loss of elders, unprecedented scales of migration, language loss, environment and habitat loss, systematic marginalization at the hands of government, regimes of extraction, acute poverty are only some of the forces that threaten the cultural erosion of indigenous knowledge today. The urgency and immanence of cultural loss has motivation a resurgence of regard for indigenous knowledge, one that can be traced back to the result of a 'successfully posited connection with development and environmental knowledge' (Warren, Werner, 1980) Scholars like Brokensha, Brush, Chambers, Richards and Warren among others, have advocated the deployment of indigenous knowledge for development, cautioned against the dismissal of indigenous knowledge as heresy and have been instrumental in drawing attention to the benefits of indigenous mythologies of knowing for policy makers and neoliberal reformers alike. While the valorization of indigenous knowledge is a much needed shift, the recasting of indigenous knowledge as valuable only in so far as it is useful or applicable to the larger project of development or conservation can be alarmingly reductive. This thesis pursues the conservation of indigenous knowledge as an objective not for its eventual deployment in development projects but from the perspective of indigenous self determination. If culture loss is a consequence of systemic exigencies that cannot be influenced by indigenous communities, the research explores a method of conservation that restores to indigenous people a means to protect and safeguard their cultural heritage from disappearance.

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2 Based on field research gathered by author in August 2017

3 Although the term 'ecological crisis' is a catch all phrase that can come to stand for many aspects of climate change, it is used here to refer to ecological crises' stemming from the practice of operating as monocultures, whether it is in energy consumption, the global supply chain for diet and its impact on resource extraction, industrial agriculture and husbandry, rapid loss of biodiversity, water scarcity and the like.

4 https://www.un.org/development/desa/dspd/

5 An old-growth forest is a forest that has attained great age without significant disturbance and thereby exhibits unique ecological features and might be classified as a climax community.

CONTEXT

Since the primary case study is located in India, among the Khasi of Meghalaya, a brief overview of the Indian context might be pertinent. The fissured landscape of Indian forests draws its roots from a history of conflict and social injustice. The legacy of colonial institutions and policy deeply exaggerated the existing scarcities of access, and gave birth to a wide range of conflicts around the issues of property rights. The confluence of forest practice, policy measures, conservation protocol and extraction agenda creates a power nexus that is enacted through top down regulation that marginalizes the dispossessed making the forest-dwelling indigenous tribal an alien in his own land. (Guha, 1997) The colonial appetite for forest resources pit them in competition with the autochthonous forest dwellers and led to the classification and criminalization of entire communities as backward castes or tribes. The People of India census recruited quasi-scientific ideas to support the criminalization of entire communities. It marked a period of transformation in the bureaucratic use of ethnographic data to substantiate native criminals. By 1924, the British government has developed elaborate ‘scientific taxonomies’ that were recast as legal parlance in the Criminal Tribes Act. (Bose, Arts & Van Dijk, 2001) A legal subterfuge cloaked in an etymological sleight of hand. By ascribing qualities of wildness to forest dwellers, gave the state free sanction to use authoritative violence, power to dispossess the inhabitants of their rights to land. Citing dubious eugenic motivations, they dubbed these communities as ‘depressed classes’ or ‘criminal tribes’. The measure was part of a wider attempt at social engineering in which the categorization of indigenous castes and tribes was means of facilitating the curtailment on forest rights.

As the colonial bureaucracy categorized the country’s constituent citizens into various states of criminality, a gargantuan task of task of state simplification that organized communities and bodies into race and caste, ascribed criminality into the cranial landscape using dubious science, spatialised race into a geography, this subjectification of the governed resulted from the demands exerted by the need for Forest governmentality. With the decimation of oak forests in England and a shrinking resource pool in Europe, the colonial project instituted a forest department that operated under the principles of scientific forestry to safeguard its resource base. The previously complex language of Indian wildness was made legible through state simplification. The dense impenetrable tracts of forests, were cleared up, the landscape was carved into grids, to prioritize maximum sustainable yield. The ‘jungle’[6] underwent a metamorphosis under the stewardship of the forest department, rejecting the chaos of its wilderness for the logic of the plantation. These landscapes were made legible, by transforming individual trees into quantitative data, where they were monitored and measured for their growth rates and loss rates. Each plot on the grid that was super imposed on the land, a factory line pledged to the pursuit of profit.

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[6] The Hindi term Jangal is etymological root for the word Jungle, which represents a quality of wildness, as a antonym to civilization, a jangli can be used to refer to an inhabitant of the Jungle but is also used to describe one who is wild, mad, savage and primitive standing in opposition to being civilized.

In 1913, the forest department earned 13 billion dollars of revenue from the scientific cultivation of India's forests (Guha,2006). The transfer of power from the British government, did not see a transformation across these systems of marginalization. Post-independence, Indian forestry was rechristened with a series of policy shifts beginning with the nationalization of forests.The criminal act was repealed, and tribes that were historically hocked in the helical bind of genetic criminality were set free. However, the categorization remained as the new government re-christened these communities as scheduled castes and scheduled tribes, slated for protection through affirmative action. Across the landscape though, forestry for commerce, in competition with the paranoia of protectionism remained the prevailing patterns. It resulted in the constitution of large forest sanctuaries and a totalizing embargo on human ingress within the core areas. (Rangarajan, 1996) But the old tendencies remained, forests that were administered through the language of state simplification still retained those methods of administration. Consider the inherent conflict of an administrative method of forest protection that conserves but cutting up the land into working grids. A top down approach to conservation unfolds spatially, preferring the language of maps, satellite data, human resource heavy interventions. This lies in sharp contrast to a rain based ecology like the soliga epistemology, that unfolds in time rather than in space, that prefers the semiotic language of rain, the shifting states of species with the the forests, the logic of ritual as a method of dwelling that simultaneously results in a conservation output.

This presents an interesting example of the dualities inherent within the landscape of forest conservation today. Who should govern and manage wilderness areas, should it be the mandate of the state, using the methods of state implication and scientific knowledge? Or should it fall to local communities through the manifestation of traditional knowledge? Should western science or local knowledge come to provoke policy? Are people allowed to continue to occupy forest lands or should these areas be purged of its population? Is protection a panacea or a problem? (Muniyappa, 2018)These dualities have stirred up the debate, with scales tipping towards the protection of charismatic mammals like tigers and elephants, towards the rights of large corporations seeking exclusive rights to mine the earth, to lobbyists in the tourism industry while continuing the historic marginalization of indigenous forest dwellers and pushing them towards a further dispossession of their homes. The khasi people are one such community, designed as scheduled tribes, living in north-eastern state of Meghalaya who possess a wealth of knowledge that has evolved in reciprocity with its constitutive environment.

On February 20th 2019, the Supreme Court ordered the governments of 17 states in India to evict an estimated 1 million tribals and forest dwelling households from their historic habitation of Indian forests. This forced exodus is not only a cultural genocide that threatens to destroy centuries of accumulated ethno-botanical indigenous knowledge and culture associated with resource management and ecologies, but also an ecological disaster that is unprecedented in India's environmental history. India's environmental ministry recently announced a controversial bill to further augment its policies of dispossession. The contentious draft Environment Impact Assessment (EIA) citing a rationale to promote the "ease of doing business", dilutes the assessment process, and effectively shuts out the public from having a say on how new projects get environmental clearances. The most controversial change in rule the draft proposes is the provision that projects can receive clearances post facto, which is a blatant derogation of the fundamental principles of environmental jurisprudence and has the potential to lead to irreparable degradation. These policies of the government adopt a radically extractive position. An extractive gaze that sees a forest only for the material resources that it can provide rather than perceiving it as a site of cultural production, as the home of vulnerable populations. There are nearly 270 million people that are living in or around forests in India, a large percentage of whom are involved in some conflict with the state, at the very extreme of the gradient is the naxalite movement, in which corporate extraction backed up government policies led tribes to abandon their way of life and take up arms in militant response. A war that according to Arundati Roy, is India's longest raging war, that is still being waged today against its indigenous people.

Indian forests have never been natural, never been free of its human inhabitants, they are synthetic entities that have co-evolved with the symphony of the monsoon in concert with human stewardship. Faced with by an overwhelming onslaught of external factors, starting with dispassion of land across the gradient to factory schools that promote cultural assimilation and instigate a re-organisation of community occupation of territory, there is an increasing need to equip indigenous people with the means to protect their knowledge and heritage against cultural erosion.

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[7] As per the stipulations of a greatly contested Indian Forest Rights Act 2006. The law provides for giving land rights to those living on forest land for at least three generations before December 31, 2005, but many communities find this hard to prove due to lack of official documentation. The Forest Rights Law itself has been criticized by both wildlife activists and those fighting for the rights of tribespeople and forest-dwellers, albeit for different reasons. The former believe giving people rights to live in forests will eventually harm the forests themselves and also wildlife. The latter believe that the implementation of the law is far from perfect and that deficiencies in this have resulted in many valid claims being rejected by the states

MOTIVATION

Contemporary research on and advocacy of indigenous knowledge builds upon the foundation of canon of several anthropologists and ethnographers like Conklin 1957, Lewis 1975, Wyman 1964, Rappaport, 1979. But there is little concurrence even till present day in questioning issues of commensurability of different forms of knowledge, the nature of ownership of specific indigenous practices, advisability of compensation, and how to view intensified cross-cultural interactions that potentially pose a threat to indigenous knowledge. The sharp power asymmetry between agents of formalized systems of knowledge seeking: whether academic, scientific, research, development driven or corporately motivated and those of indigenous practitioners is sufficient reason to give pause and consider alternative practices of conservation that comply with an ethics of intervention.

Traditionally most methods of conservation that have been employed in this context proscribe Ex-situ conservation: the creation of databases to ameliorate the significant and imminent risk of losing Indigenous knowledge. They exist across a range of different institutional scales from international agencies like UNESCO and the World Bank, National archives and registers to civil society conservation action. These databases can largely be classified as having two objectives. The first is protection and the second is analysis: of general information to identify specific nuggets of useful applicable knowledge that can be then generalized for future use in development and conservation contexts (Agarwal, 2002). Though they have some measure of limited success in conserving knowledge , these methods are critically deficient in protecting indigenous rights. These databases are digital mausoleums as far as the communities are concerned. They also accomplishes a process of translation that robs indigenous stewards of their right to authorship and can sometimes disregard the politics of ownership that accompany indigenous knowledge. The medium therefore in its adherence to pragmatism practically flattens the diversity of knowledge that is characteristic of indigenous forms (Agarwal, 2002). In doing so it misconstrues the very characteristic of indiginaeity that render such knowledge indigenous or local or intimate. Extracting specific parts knowledge from the milieu of its production and subjecting it to a transposition of a radically different environment through translation mutes culturally produced forms of knowing and experiencing knowledge.

This research explores how new forms of media can offer a discursive dialectic to the challenges listed above. If the medium of a database can indeed be reimagined to record indigenous ontologies, knowledge and practices in the first voice, would this resist the reduction evidenced by existing databases? How can knowledge be documented in ways that retain the authenticity of the environmental factors and ontological factors that led to its production? How can technology enable in-situ conservation at the hands of its knowledge stewards? In seeking an answer through design, this research directs its motivations towards addressing the asymmetry of power relations that characterize indigenous self determination in regards to their knowledge.

A small but important caveat necessary to foreground this thesis is a caution associated with the term ‘Indigenous’, it is a loaded term that has a fraught history of unequal power relations. I refrain from defining both the term or the category of indigenous knowledge as both these appellations have undergone various transformations depending on the time the context and the agenda underscoring its use. This research adopts the position that it must serve first and foremost the communities themselves whose knowledge is recorded according to their values and needs rather than serve outside agendas be they academia, the state or policy.

III

THESIS GOALS

This research aspires to develop a methodology of in-situ conservation by crowd-sourcing indigenous knowledge and documenting oral histories, ecological memory and practices relating to ecosystem management to soften the threshold into oblivion[8]. The tool; SCRIBE is designed to address twin problems that plague indigenous communities: the sustained survival of knowledge and the conservation of indigenous culture. It attempts to document, bear witness and conserve while protecting communities from bio-piracy where indigenous knowledge is patented for profit, bio-prospecting and strengthening indigenous agency.

The thesis goals are:

1.The design development of SCRIBE and its testing with the Khasi community.
2.Documentation and multimodal data collection of the Khasi's synergistic architectural practice of weaving root bridges .

The design of this tool will address indigenous knowledge as valid, not necessitating a justification by the scientific method. It seeks to re-position the authority of the 'first voice' and enable indigenous agency through the framing of their own narratives outside the confines of the academic canon. Traditional indigenous knowledge has historically been a degraded landscape subject to extraction and translation in the service of science, with little regard to issues of authorship leaving Indigenous communities vulnerable as a result. This thesis explores design solutions that protect against extractive agendas.The thesis also suggests that different methods of investigation reveal different relationships and espouses a non dualistic approach that privileges both the scientific as well as indigenous ways of knowing.

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8 Culture is a dynamic entity, subject to pulses and blooms. Things are devolving toward, or evolving from, nothingness, and in ecology it is disturbance that mediates the transition. We are all born with the promise of death. It is this immutable fact of death that informs different cultures' particular dialogues in negotiating the duality of transience and permanence. However western frameworks of conservation, especially heritage conservation, takes on a position of swimming upstream against the current of time to stave off its degenerative effects and preserve a moment, an artifact, an entire culture in a state of 'authenticity' to an original moment. The authors espouses a view of conservation that recognizes time's arrow a morphological force, demanding a creative conservation of culture, where the objects, artifacts and cultural practices are given the opportunity to evolve in response to the changing content to thereby ensure its survival. However when the rate of change is so rapid that culture can longer survive, a method of intervention, in the author's own opinion can serve to soften the threshold, create a holding ground for cultural practices that would have been lost to a flooding onslaught of accelerated change.

2

THESIS METHODOLOGY

RESEARCH METHODOLOGY

The methodological approach underpinning this research draws heavily from several disciplinary domains. Foregrounded by the identification of individuals/organizations who would serve as community partners, the research methodology defers to the wisdom inherent in their cultural practices in organizing all interactions with the relevant stakeholders. With a specific focus on gathering of data from various community members and stewards of traditional knowledge. The research began with a consultation with community leaders and takes a qualitative approach to data gathering. Data collection for this research has two objectives, the first is the documentation of indigenous knowledge, using photography, audio recording and video. Inspired by the discipline of multimodal anthropology the data collection adopts an participative, empirically-based, qualitative framework, built on systematic observation, identifying the research cycle that begins with data gathering and leads to visual ethnographic construction that is anthropological in method, process, and product. The second cycle of data collection involves registering user feedback on the development of the tool SCRIBE. In designing the tool, I draw upon methods from the design canon, of design thinking, community centered design operating under the transition design framework developed in Carnegie Mellon. The epistemological structure of this research is positioned within the frames of critical conservation, interpretivism, and subaltern and critical indigenous studies.

The project aims to present a methodology for in-situ conservation using new media and technology . The theories employed in this study aim to respect indigenous self-determination, and recognizes communities right to self representation while explore a design solution that align the aims and objectives of all associated parties. The data obtained has been used to develop a design direction that fosters indigenous agency, cultural authenticity and respectful engagement with Indigenous knowledge with a deep awareness of the embedded power asymmetry.The analyzed data was then used to inform the design considerations for SCRIBE, as a a method of in-situ conservation. Although the design of the SCRIBE tool, is far from complete and only represents a first draft of engagement, it represents the final outcome of this masters research.

User testing and stakeholder feedback have been used to test the viability of the tool and provoke further design iterations, suggesting lessons for design practitioners and researchers (Indigenous and non-Indigenous) in methods of ethical engagement with indigenous knowledge as it pertains to issues of representation, documentation and conservation. The qualitative frame is a necessary condition for this method of research because it gathers and makes room for the myriad cultural ontologies that indigenous knowledge can comes to possess, as well as the diverse demographics of stakeholders who are charged with its protection. This research position is deeply cognizant of the dramatic power imbalance between the community and the researcher knowledges this cultural, professional and power asymmetry as intrinsic to the research question.

II

LITERATURE REVIEW OF THE DESIGN AND ANTHROPOLOGICAL METHODS

Since its inception with the Bauhaus tradition, design pedagogy and tools have developed a robust academic and industry related framework. Although the Bauhaus developed a robust design pedagogy, its commitment to its own slogan, 'Art into Industry' speaks to its evolution as a commercial presence. It began as a utopian craft guild combining architecture, sculpture, and painting into a single creative expression. Espousing a extensive craft-based curriculum that was meant to churn out artisans and designers capable of creating useful and beautiful objects, design was in the Bauhaus agenda a tool used to manipulate material and aesthetics towards a utilitarian principle. Historically there emerged several different methods used for the design of products, services, technologies and systems drawing from disciplinary requirements of art, architecture, design and engineering. Each of these methods emerged in dialectic response to the shortcomings asserted by the previously adopted models, and a brief overview of the methodology that will inform my thesis will prove useful. Although Rolf Faste and McKim's are credited with the academic origin of design thinking, as it emerged in Stanford University in the 1980s and 1990s, when they taught "design thinking as a method of creative action", it was adapted and gained popular appeal by David M. Kelley, founder of the design consultancy IDEO . It refers to a set of practices underpinning the design process in understanding the human needs related to a problem, reframing the problem in human-centric ways, developing ideas through brainstorming, testing through hands-on prototyping though several iterations based on negative feedback loops. Its hallmarks according to IDEO are empathy, optimism, iteration, creative confidence, experimentation, and an embrace of ambiguity and failure. Though most designers today still ground the early investigations of their design practice using these tools,. Design thinking as a method fails to capture the complexity of most problems because it is ill suited to deep collaboration. The anthropocentric view it espouses through an explicit focus on user centric/human centered design makes it a flawed tool especially when working with ecosystems and non human actors. Design thinking evolving as it did from a history of commercial use and application also fails to capture the complexity and nuance necessary for working with historically marginalized communities.

The discipline of design saw a reflexive shift during the historical moment when Elinor Ostrom, won the Nobel Prize in Economics. It represented a shift from regarding the individual as the fundamental unit of systems to a pronounced emphasis on the network as the fundamental unit of systems, while studying methods of engaging with the commons. The popularity of user centric and human centered design gave way for a Community-Centered Design with a focus on ecological congruent solutions. By studying the community as the focal point of design research, this methodology expands its ambit in the consideration of stakeholders. The evolution of participatory design extends upon these ideas by shifting the role of the community from a passive to active state, where they are invited to co-operate/ co-design with designers, researchers and developers. (Pieters, Jansen, 2017) This collaboration takes place during several stages of the design cycle: from the initial exploration, problem definition, ideation, devising solution and evaluation. According to Pieters and Jansen, it is a "transparent process of value creation in ongoing, productive collaboration with, and supported by all relevant parties, with end-users playing a central role" and covers all stages of a development process. With its emphasis on methods like storytelling, workshops and engaging community input to develop shared design objectives, it provides a important foundational methodology upon which to ground this research. However it fails to address the important issue of transforming the inherent power relations embedded within the discourse of indigenous knowledge and therefore I draw upon the principles of transition design. Transition Design is a radical area of design practice, study, and research that advocates design-led societal transition toward more sustainable futures. Arguing for a transformation at the scale of paradigm rather than at the scale of product or practices, transition design demands a re-imagination at a systemic level accommodating shifts in energy infrastructure, economy, health education and lifestyle to name a few. It exhorts the need for a "cosmopolitan localism," that is place based and regional despite being global in arenas of information and technology (Irwin,2015) . Designers well versed in this method are expected to have deep operational knowledge of the interconnectedness of social, economic, and natural systems and the Transition Design framework propounds four dynamic areas in which narratives, knowledge, skills, and action can be developed. They are Vision; Theories of Change; Mindset & Posture and New Ways of Designing. While considering the unequal position of indigenous people as explicated in earlier sections of this thesis document, with a simultaneous motivation to seek to shift these embedded power imbalances, a transition design framework provides a more robust methodology within which to ground this research.

I also draw in part from the discipline of Systems architecture, an emergent response within the engineering discipline that attempted to redress the weaknesses of traditional engineering by focusing on contextual and stakeholder perspectives within the engineering and design processes. The merit of a systems architecture framework lies in its ability encapsulate discrete but interconnected elements as components within a system whose architecture enables a formal representation of its constituent parts that highlights their relationships. Crawley et all define systems architecture as an "abstract description of the entities of a system and the relationships between those entities" Despite its usefulness in providing a model to unpack and design complex systems, it is also important to consider its provenance in the military industrial complex, an epistemic grounding that presents this method with its own set of limitations.

The objective of documenting indigenous knowledge thorough an emphasis on ethnographic research suggests a grounding in the anthropological method. The discipline has evolved greatly since its inception and has reflectively expanded to incorporate dynamic media perspective under its ambit. Multimodal anthropology is a recent species within the discipline of social cultural anthropology that comprises anthropological research with knowledge production across myriad traditional and new media platforms and practices including but not limited to documentary film, ethnofiction, video, still photography, theatre, design, mobile applications, virtual and augmented reality, web-based interactive gaming, social networks. (Collins et all, 2017) The advantages of the multimodal approach is that captures ethnographic data in the moment of its production with the greatest accuracy considering the loss (of information, context) that data is subject to in the act of translating, from medium to medium or as Latour viscerally reminds us through the circulation of reference. (Latour, 1999) It also offers an invitation to consider the consider the role of these technologies themselves as actants in the lives of the interlocutors, ensuring that the method itself is subject to critical anyalsis.

As a designer trained exhaustively under a western pedagogy, it is natural and almost instinctive to reach for methods that emerge from my own educational framework, but its also imperative to pause briefly to consider the history of these methods emerging as they did from the exigencies of industry and capitalism. These are the same forces whether by design or unintentionally have served as catalysts for cultural appropriation the world over. Design has performed great acts of extraction, mining cultural symbols, sacred iconography and transposing these cultural presences into commercial artifacts. The engineering discipline and its constitute tools have provided the mythological impetus to enable the majority of high modernist projects, and early anthropology while drawing our gaze to indigenous people drew our gaze there only to label them as primitive, to etch them into categories of the other. It is imperative to consider how to investigate issues of identity, cultural representation and de-colonisation while employing these methodologies. It also imperative to consider the hegemony of the design aesthetic as a language. With the increasing standardization and homogenization of what is beautiful or considered aesthetic from a graphic design, software design or ergonomic perspective, these notions of beauty and harmony are notions that have emerged from a very specific context. Even today arbiters of taste and refinement, still occupy an institutional presence among the world's leading museums and art galleries and there is a great danger of imposing the hegemony of an alien aesthetic upon an indigenous context.

III

RESPONSIBLE CONDUCT OF RESEARCH

The research was undertaken after approval from MIT's Committee on the Use of Human Experimental Subjects. Working with indigenous communities and their knowledge presents an ethically loaded challenge and any intervention is simultaneously invested with the ability to be be both panacea or poison, because it concerns itself with vulnerable communities, the asymmetric politics of knowledge production, it might leave cultures open to exploitation by biopiracy or profiteering, and it renders visible knowledge that might have necessarily evolved to be opaque.

The research is conducted keeping the Ethical Principles for Safeguarding Intangible Cultural Heritage as guidelines. Elaborated in the 2003 Convention for the Safeguarding of the Intangible Cultural Heritage, as international normative instruments to protect human rights and the rights of indigenous peoples. They represent a set of overarching aspirational principles that are widely accepted as constituting good practices for governments, organizations and individuals directly or indirectly affecting intangible cultural heritage in order to ensure its viability, thereby recognizing its contribution to peace and sustainable development. Complementary to the 2003 Convention for the Safeguarding of the Intangible Cultural Heritage, the Operational Directives for the Implementation of the Convention and national legislative frameworks, these Ethical Principles are intended to serve as basis for the development of specific codes of ethics and tools adapted to local and sectoral conditions. Since this research has a heavy emphasis on documentation, it also uses the World Intellectual Property Organisation's toolkit on the documentation of traditional indigenous knowledge as an operative guideline.

3

THE TERRAIN OF MARGINALISATION

Academic interest in Indigenous knowledge finds its provenance in development literature. Indeed perhaps the earliest use of the term ‘indigenous’ was recorded in 1979 by the Robert Chambers’s group at the Institute of Development Studies (Warren 1998) The notion that indigenous knowledge could be seen as a reservoir of alternative wisdom that could be useful for sustainable development emerged in response to the failure of top-down technocratic models of development employed the world over, models that failed to account for the specificity of local conditions or place based knowledge emerging from a relational affective sociality. (Ferguson 1997. Grenier 1998. Scott 1998)

The term indigenous knowledge has undergone several transformations in perception as well as popularity. This chapter traces the historical vicissitudes of this changing attitude and its subsequent polarization into a category as distinct from science. At first, spurred by an anthropological interest, Indigenous knowledge was brought into the realm of popular imagination, and although the presence of a rich and complex heritage of knowledge was alluded to, more mysteriously through its absence than its explicit presence, it was cast as primitive and unscientific as the superstition of the savages. The blind faith in the scientific method as the answer to progress continued well into the industrial revolution and the project of modernity. It was only after the radical failure of high modernism that saw a resurgence of interest in Indigenous knowledge, this interest positioned indigenous knowledge in sharp contrast to science and hailed the knowledge held by local communities as complex, holistic and critical to any development project. These views professed an arduous almost romanticized view of indigenous knowledge as a irreplaceable fount of wisdom that could serve to correct the fatal flaws of the high modernist vision. It also pledged the value and future of indigenous knowledge to be tied to a future of development based agenda. Although there has been a wealth of academic attention drawn to the discourse of the dichotomous categorization that pits indigenous and scientific knowledge as two separate and distinct categories, I find such arguments a rather time tired dialectic that are not very useful in truly engaging complex questions of indigenous knowledge conservation. It is much more valuable to adopt a non dualistic agenda, and consider how the two ontological categories enter into dialogue with one another. If distinctions must be made however between forms of knowledge, there is merit in considering what forms of knowledge are inherently ascribed, or generate power for its holders, how do we explore power and its relationship to knowledge as constructive and restraining force. To consider issues of power and powerlessness is central to understanding the position and transformation of indigenous knowledge, as well as its deployment as a political presence to secure justice for its constitutive communities.

TO BE PRIMITIVE AND UNSCIENTIFC

In its earliest articulations, the local knowledge held by autochthonous cultures was disregarded as superstitious and primitive. The civilizing mission, the radical ethnocentrism and the elitist gaze of twentieth century science deemed such forms of knowledge emerging as they did outside the canon of western science, or the sites of production of formal knowledge.i.e institutions, laboratories as 'primitive' and 'unscientific'. (Agarwal, 1995) It justified its position with a hammer of methodological reductionism and evaluative parameters drawn up by the scientific method. The phantom presence of indigenous/local knowledge is seen and felt viscerally, through the poetics of absence. Fieldwork that swelled the canons of scientific literature during the late colonial period drew heavily upon the foundation of indigenous knowledge, with a characteristic elitism that obscured names of sources or muted indigenous voices.

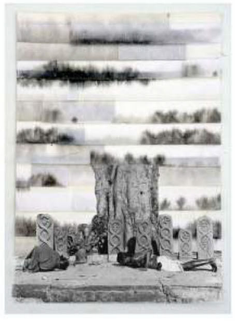
Consider this literary example: Among the many colorful characters brought to life in the Ibis trilogy, a masterpiece of historical fiction by the writer Amitav Ghosh is Frederick Fitcher Penrose, an accomplished botanist, plant hunter and horticulturalist on an expedition to China to collect rare plants. The narrative unfolds in the early 19th century, its characters deftly woven through the machinations of the East India company as it sows the seeds to birth an opium trade that ensnares its colonies in India and China in an ecological imperialism that spans several centuries. As an owner of a nursery called Penrose & Sons in Cornwall, Fitcher accumulates a considerable amount of wealth through the sale of illegal Chinese (biological) imports. His modus operandi of obtaining exotic species from the wealth of diversity in China for sale in the occidental world, earns him esteem, honors and prosperity by virtue of his repeated expeditions to Canton in search of rare and precious species and his success in garnering and transporting those plants to Britain. Despite being on the fringes, as a tertiary character, Fitcher's quest for the rare and precious plants, chief among them the Golden camellias is an exemplary literary metaphor that captures the zeitgeist of bioprospecting and ecological extraction that piggybacked the colonial enterprise. Armed by the impetus to discover, explore, conduct research and pursue profit, several expeditions ensued the world over. In Fitcher's case, his determination to secure strange species clashed with the Chinese prohibitions on transporting live specimens from the country. Undeterred by such legalese, these constraints only served to heighten his creativity, carrying dried specimens and seeds in makeshift greenhouses. He travelled with a painter whose art served to make visual catalogues upon which to plan future exploitative excursions. His adventures led him to contract locals who would go on to serve as guides and crew for his vessel, Redruth. Another project of extraction ensues as he mines his crew's tacit knowledge and expertise in seeking rare and exotic species. Their local place based knowledge developed over centuries of observed embodied intimacy now at Fitcher's fingertips to aid in his enterprise of botanical exploration and economic emolument.

The nascent landscape of colonialism saw a slew of explorers the world over, from Carl Linnaeus studying Sami ethno-medicinal knowledge in Lapland in 1973 (Zorgdrager, 2018) Hans Sloane in the early 17th century exploring the indigenous flora and fauna of the west indies aided by faceless, nameless local people or Joseph Francis Charles Rock who distinguished himself as an explorer, linguist, botanist, geographer working (among others) in Tibet with the Nakhi people. Such tenuous and asymmetrical partnerships with local people were crucial to the process by which species were discovered and made legible, to use James Scott's terminology to the canon of western botanical sciences. Despite evidence from pre-Columbian rock drawings that provide evidence of centuries of ayahuasca use, the plant was purported to have been discovered by Western science and botanical explorers. Ayahuasca first entered the western imagination in 1851 with an encounter by the British plant explorer, Richard Spruce, when he found the Tukanoan Indians in the upper Rio Negro region of the Brazilian Amazon using a liana (vine) known as caapi to induce a state of intoxication. Ecuadorian geographer Villavicencio first mentioned ayahuasca in 1858 while he was exploring the jungles of Ecuador, and Richard Evans Schultes is considered the first to academically examine Ayahuasca (Mckenna, 1992). It is not particularly surprising then that the category that is today known and classified as indigenous knowledge has been closely entangled with western knowledge from as early as the fifteenth century, sharing an intimacy that evolved through contact, contrast, transfiguration, osmosis, communication and study over several centuries. (Abu- Lughod, 1987-88, 1989; Schneider, 1977; Wallerstein, 1974, 1979, Wolf, 1982). Indeed it is impossible to maintain the notion that indigenous and western knowledge remained two pristine categories, unaltered by the other. If anything it was the absence of historical scrutiny from the discipline of anthropology that painted an picture of these cultural systems authentic and timeless, until the moment of a breach, by 'cultural contact' (Dirk et al, 1994).

As the post colonial landscape bloomed into the modern, it saw the continued condemnation of indigenous traditional knowledge as 'unscientific'. Modernity's teleological push towards progress and development meted out models and theories developed and christened in formal institutions as 'technology' which was subsequently used upon the constituents of the underdeveloped nations (Ellen and Harris 2000). From the ivory tower of modernism, advocates of development projects still considered indigenous knowledge to be fundamentally irrational, mystical and superfluous (Howes and Chambers, 1980, Brokensha and Riley, 1980) In India for example, its forests are have historically been synthetic entities shaped by the drumming of the fire to the beat of the monsoon. Its indigenous people have evolved knowledge to exploit fire as a generative ecological design parameter. Forests were set aflame to make way for agriculture, whose subsequently abandoned fallow "converted organic residues into fertilizer, kept woodlands and prairies in grass and cleansed soil of pathogens. Fire structured the intricate ensemble of biomes that was made by, and that in turn made possible, Indian society." (Pyne, 1994) The arrival of the British inserted an enduring silence to the drumbeat of fire and water that danced across the land. It exposed its economy to cycles larger than the annual pulse of growth and decay and 'shrank the encircling fire into the combustion chamber of steam engines. The inability of the British to understand fire's generative role, led to a forest 'management' that primarily centered on fire suppression through the principles of scientific forestry. This colonial attitude subsequently transformed into the secular science of conservation. (Guha, 1997) It laid the historical foundation for the still enduring state sponsored rhetoric that marginalizes the indigenous forest dwelling tribes and frames their habitation as detrimental to the environment. Not only was indigenous knowledge considered inferior and lacking in scientific validity (Howes and Chambers, 1980, Brokensha and Riley, 1980), the literature also deemed that indigenous habitation and practices were detrimental to the environment due to over-exploitation and over-consumption of resources rather than recognizing that the source of the problem was the radical impoverishment and historic marginalization that they had been subject to. (Ellen and Harris, 2000).

These denigrating views continued to enjoy a measure of popularity until the persistent failure of authoritarian high modern development projects that eschewed a top-down approach. For example, where previously dams were hailed 'as the temples of modern India', these development projects failed across several verticals as they released greenhouse gases, destroyed carbon sinks in wetlands and oceans, deprived ecosystems of nutrients, destroyed habitats, increased sea levels, waste water and displaced poor communities. The green revolution despite its early promise saw a loss of soil fertility, massive soil erosion and soil toxicity, a diminishment of water resources, the pollution of underground water, increased salinity of underground water, increased incidence of human and livestock diseases and global warming, or even the famine that followed China's Great Leap Forward. The catastrophic failure and development disasters of the twentieth century were rooted in a noxious fusion of epistemic arrogance and authoritarian power, including especially an excessive confidence in the ability of principles of "scientific management" to order and organize human activity. (Scott, 1998)

II



MORE THAN SCIENCE.
INDIGENOUS KNOWLEDGE REVIVAL

The surge of interest in Indigenous knowledge in dialectic opposition to the failure of high modernism based development emerged with a fervor that has been characterized by some scholars as a ‘revolution’ (Stilltoe,1998). Signifying a much needed paradigm shift in focusing attention and resources away from technocratic, centralized systems towards the historically marginalized poor, theorists of indigenous knowledge gained a vocal platform on the theatre of development, of ‘a sustainable development’ as a solution to the failures of high modernism. The fascination with indigenous knowledge is motivated largely from four types of sources: development and environmental management strategists and researchers, business interests, and indigenous people themselves.

Though couched in the undertone of romanticization that painted indigenous people and communities as if perpetually dwelling in idyllic harmony with nature, the importance of this traditional knowledge practices for the protection of biodiversity and the achievement of sustainable development gradually gained universal recognition (Gadgil et al, 1993).Communities, cultures and people that are stewards of such knowledge, who employ it in their practices of dwelling act not as mere technicians but as scientists operating using complex notions of classification, abstractions and philosophical ontologies that provide a systematic account of the world (Sundar, 2000)

The literature is replete with examples of indigenous knowledge systems that reveal new insight previously unrecorded or unexamined by science, whether it is the traditional management of intertidal clam beds by Kwakwaka'wakw (Deur, Dick 2015), the cultural designation of sacred forests in protecting climax stands (Gadgil,2006), the rain based ecological practices of the Soliga (Si,2006) among several others. The ecological intimacy of local actants results in a corresponding intimacy with plants and other species, a deep embodied knowledge of the changes in the ecosystem and climate, and is often touted to have comparative advantages over scientific knowledge in the discipline of development studies. This shift was reflected internationally when Article 8 of the Convention on Biological Diversity adopted the resolution to "…respect, preserve and maintain knowledge, innovations and practices of indigenous and local communities embodying traditional lifestyles relevant for the conservation and sustainable use of biological diversity…." (United Nations, 1992) As noted by various commentators (Johnson, 1992; Berkes, 1993), the World Conservation Strategy (IUCN et al., 1980) of the International Union for the Conservation of Nature and Natural Resources, and the Brundtland Report, Our Common Future (WCED, 1987), have all recognized the value of traditional knowledge. In 2003, the UNESCO General Conference adopted the Convention for the Safeguarding of the Intangible Cultural Heritage.

It is a fine razor's edge to walk, between valorization and extraction. While Traditional or indigenous knowledge has been discovered by the scions of development and recast as a model for a healthy interaction with, and use of, the environment, and as a rich source to be tapped into in order to gain new perspectives about the relationship between humans and nature. The shift to a bottom-up grassroots based development, hailed indigenous knowledge as a hallmark of sustainability and enlisted the advocacy of market liberals, that foster market intervention and hinder state involvement/protection and Neo-liberal civil society action spurred by the mandate of participation and empowerment. It led to period of interest in which researches turned their gaze to indigenous people and their practices with the objective of 'scientising' the most useful aspects or culling 'the best practices' for application in generalizable contexts. (Stilltoe,1998) Several studies, (Guha, 1997, Baviskar, 2000, Apffel-Marglin, Tindall, Shearer, 2017) have demonstrated how synthetic our ecosystems are, how the human mind is an ecological mind that reflexively designs the ecological identity of environments from within. The flourishing and survival of ecosystems and its constitutive people is now generally regarded as proof that the cultural practices of their dwelling result in a conservation outcome for the former and that their knowledge is pivotal for sustainable development. (Anderson and Grove, 1987; Compton, 1989; Flora and Flora, 1989; Ghai and Vivian, 1992; Inglis, 1993; Moock, 1992; Sen, 1992).

In contrasting indigenous 'traditional' knowledge in sharp relief as a distant and separate category from modern scientific knowledge, theorists of indigenous knowledge, run the risk of fostering a false dualism, and a romanticization of all indigenous knowledge, as traditional, unchanging, authentic and inherently sustainable. What is perhaps even more dangerous is the valorization of indigenous knowledge on the grounds of its usefulness for development. Its significance in generating a 'development from below' (Brokensha et al, 1980) to facilitative cost-effective, participatory, and sustainable interventions, as a valuable resource for scientists and planners striving to improve conditions in rural localities, is a chief characteristic that Warren highlights in a paper prepared for the World Bank. This rhetoric emerging as its does from development literature, ironically echoes the binary dichotomy of the earlier episteme, that separates indigenous knowledge from the scientific.

The radical romanticization that underpins some of the interest in Indigenous knowledge runs the risk of oversimplification, generalization and decontextualization while exacerbating the tired trope of a binary duality. The consumers of such knowledge often endorse the packaging, extraction of knowledge by the use of blanket terms like participation, empowerment, democratization while accelerating self serving objectives of development, whether these are NGO's, international institutions like the World Bank that still espouse objectives of high modernisms couched in Neo-liberal camouflage. Though Indigenous people do welcome the elevation of status that comes with increased recognition of their knowledge systems after centuries of dismissal and disintegration, and have strategically launched campaigns of activism to secure a modicum of political influence, nothing comes without a cost (Eyzaguirre, 2001). In a move that resembles colonization, development's interest in the Indigenous Knowledge enterprise may yet displace the indigenous from their historic possession of their knowledge.

III

TOWARDS A RADICAL NON DUALISM

In a piercing insightful critique that systematically disproves the dualism described above, Arun Agarwal (1995a, 1995b) acts a torch bearer for the school of thought that espouses a non dualistic perspective. His analysis of the literature reveals that the previous theorists of indigenous knowledge claim its difference from scientific knowledge on largely three grounds:

1.Substantive: That indigenous knowledge is concerned with the immediate and concrete necessities of people's daily livelihoods, while western knowledge is abstracted and philosophical in its attempt to construct general, universal explanations.

2.Methodological & Epistemological: That science is open, systematic, objective, analytical and characterized by rigor founded on previous achievements. In contrast Indigenous knowledge is closed, non-systematic, and lacking in objectivity and rigorous analysis.

3.Contextual: That traditional knowledge systems are embedded in the social, cultural and moral milieu of their particular community. In other words, actions or thoughts are perceived to have social, political, moral and cosmological implications, rather than possessing only, say, a purely technological dimension. By contrast, science does not necessarily incorporate all these various dimensions. Technical questions relate specifically to cause-and-effect relationships in the natural environment, and can coexist independent of social, moral, political or cosmological contexts.

Disputing these claims of difference across all three grounds and in a sentiment that echoes the old adage, 'There are as many ways of knowing as there are knowers', Agarwal suggests a move past time tired dialectics like western/scientific, traditional/modern towards a reconciliation that celebrates the diversity inherent in these two categories. In recognizing how cultural knowledge or tradition comes to be transformed as scientific knowledge and eventually accretes into scientific practice, it recognizes previously muted accounts in which western science has historically extracted, recruited, translated and assimilated local knowledge. It invariable alludes to the entangled relationship between the categories indigenous and scientific knowledge and complicates our ability to neatly distinguish between the two. He demonstrates the absurdity of fixing knowledge permanently as 'indigenous' or 'western' especially considering the contradiction that the same knowledge can be classified either way depending on the agendas concerned. As Korzybski described, 'the map is not the territory' suggesting that different maps reveal a diversity of differences across the same territory, similarly different ontologies reveal a new perceptions and knowledge about the material world. The representation a function of the observer's view. It paves the way for the perception of several embedded diversities, (even several different contesting indigenous perspectives perhaps operating within the same locality) across a spectrum of ontological difference rather than across binary categories.

The emancipation of indigenous knowledge as a dualism separate from western/scientific knowledge is critical because it disentangles itself from the agenda of sustainable development and demands a deeper investigation into inherently coupled relationship that power holds with knowledge. Sustainable development necessitates the co-operation of grassroots organization, it demands local participation and support of culturally situated actants to ensure success. Political mobilization may depend on using indigenous knowledge as a strategic toehold (Baviskar, 2000) opening up a domain for representation in national politics or international forums, aid agencies and human rights organizations. Such activism remains destined to be flawed if it regurgitates the politics of 'othering' (Bal. 2000) rather than seeking to fundamentally alter the asymmetrical power relations that are at the root of their historical disadvantage. Much like the ramoras hitchhiking on an itinerant shark, these uneven power relations also paves the way for the neoliberal market to enter and establish a stronghold within indigenous domains. The United States of America has earned the dubious acclaim of being one of the largest consumers of indigenous knowledge. With pharmaceutical, horticultural and agricultural industries profiteering off the traditional knowledge of indigenous peoples. (CRS Report for Congress, Biotechnology, Indigenous Peoples, and Intellectual Property Rights) 1993 Whether its corporations breaching cells walls and yanking out its DNA for a vigorous edit, enlisting life's miraculous self replication as an cost effective employee in a production line, screening plant genome samples from biodiverse regions for use in fertilizers, pesticides, dyes, and cleaning products or searching for the next panacea drug among indigenous plant lore, this particular brand of bio-prospecting is only one of the avatars in which the market comes knocking.

The marketization of such forms of knowledge, as well as the scientization of indigenous knowledge is based on a litmus test of use. Such knowledge is considered valuable and indeed demands a conservation based on its usefulness to industry, development or progress. In ignoring the inherent validity of such forms of knowledge, it draws attention away power asymmetry between indigenous actors and the other constituents,.ie state, development actors, academia, corporations, from the responsibility of transforming this disproportionate power balance and while furnishing formidable social actors to appropriate useful indigenous knowledge to serve their agendas. In order to truly engage indigenous knowledge, and consider its conservation, it is imperative that we push past polarizing dichotomies and focus on strategies that evoke substantial autonomy for indigenous peoples.

IV

POWER AND KNOWLEDGE

Although the assertions of sustainable development often cite the objective of 'empowering' marginalized groups, it rarely pulls focus towards redressing and transforming the existing power relationships that are crucial to the flourishing of indigenous people. It becomes critical to consider how the category of 'indigenous' is constructed by the workings of power, and how power becomes the property of what comes to be categorized as Indigenous (Agarwal, 2005) for its viability in making legible the nature of political strategy used by proponents and critics of indigenous knowledge. Foucault's discursive critique of the relationship between knowledge and power can be vastly instructive in excavating the power asymmetries present in relating to/working with indigenous knowledge. To articulate a scientific discourse is disseminate knowledge as power, perpetuating a historic cultural asymmetry and hierarchy.

To truly take into consideration the validity of indigenous knowledge, Foucault would suggest, demands a reactivation of local knowledge, with a recognition of their standing, disallowing any instance of subjugation of the knowledge itself. Foucault regarded modern science to be inherently a colonizing force, which employs process of normalization in pursuit of scientific rationality. He claims that scientific disciplines define a code of normalization that simultaneously demands a theoretical horizon that spans the gamut of the human sciences. (Foucault, 1983) As a result of this normalization as it relates to research, its eventually accretion into the scientific practice, its consolidation as truth, knowledge and eventually power it becomes critical for indigenous people to remain vigilant to the mechanics of the coercions exercised by knowledge as it operates as power. As Foucault explicated, science's crusade for truth is less about the cluster of truths waiting to be discovered and established than it is a about a cluster of truth that separates true and false that applies specific attributes of power to those that are designated as true. A process that Bruno Latour explores in some detail as he describes how some knowledge systems, based on the strength and length of their networks merit designation as universal or become discarded as parochial. Where explanatory power relies less on truthfulness than the successful cooperation of political, cultural and biophysical actants. (Latour, 1986) The global penumbra of scientific rationality, casts its shadow upon the indigenous world with the objective of transforming of indigenous knowledge and assimilating it to suit to the mandate of Western scientific–technological rationality. In assessing the protocol relating to the interaction of actants (be they motivated by research, state sanction, development agenda or market forces) with indigenous knowledge, it becomes critical understand how they manifest their agendas in relation to their inherent power—do they articulate their position with the primary intention identifying indigenous knowledge, protecting indigenous culture, reactivating local knowledge so that it stands without being subjugated; or do they primarily insist on exercising a power over the object/subject of its investigation dispassionate towards notions of indigeneity that presents a challenge to the juridical assertion of modern science? (Swazo, 2005)

The mechanics of consent offers an interesting toehold upon which to unpack some issues central to collaboration with indigenous communities and their constitutive knowledge. Instruments of intellectual property rights patent law and apparatus of informed consent have been co-opted to become tools of legalized western deception and theft. (Swazo,2005). Alternatively, Free, Prior and Informed consent of the local stakeholders is a mandatory milestone for the progression of any development, or research project. It highlights an interesting paradox that demands some excavation. Research on indigenous knowledge cites the necessity, the urgency of its conservation based on the rapidity of its cultural erosion as due to modernization, globalization, industrialisation, dislocation, economic growth among other factors. It demands the conservation of such knowledge based on its importance in improving scientific knowledge and its usefulness in advancing future development, and therein lies the rub because it was development that threatened the survival of such knowledge in the first place. If consent acts as a checkpost for development, at what stage do indigenous communities offer their consent to development? Call it modernity, progress, development or scientific inquiry, there is no halting the leviathan as it seeks out its logical teleological stride into the future. Consider the Human Genome Diversity Project, there remained no question of halting the advance of population genetics from the perspective of the population geneticist, physical anthropologist, or international bioethicist, despite several demands from indigenous groups. (Swazo,2005). The advance of science or progress by the state or incursions by the market are rarely constrained or restrained as a result of consent from indigenous actants. In fact one could make the argument that modern scientific–technological rationality offers a permanent provocation in asserting its goals over indigenous people and that indigenous culture is not recognized as a kind of permanent limit to scientific investigation or immune to the machinations of sustainable development. It presents people who seek to engage discursively with indigenous people and their knowledge a difficult challenge, how to engage with the notion of free, prior, informed consent as a horizon, as always contingent and subject to change, where consent can be withdrawn at anytime depending on a change in circumstances.

Power can be regarded as a negative articulation in so far as it acts a constraint upon the freedom of the subject or be regarded as a positive articulation by enabling in the subject a freedom to overcome constraints. Agarwal suggests trying to understand this distinction by considering the difference between power to and power over, a whole world of difference from this subtle shift of prepositions, the latter is self directed while the former relational in order to thicken the language used to describe perceptions of power politics among indigenous actants and other constituencies to understand their agency over processes of marginalization in matters of economic growth, expansion of political processes, and state interventions. A Foucauldian critique of modern forms of knowledge and power invests us with a heightened desire for vigilance in engaging with indigenous knowledge in so far as the knowledge/power relation expressed by the contraposition of development/state intervention/academic research/ market intervention/political mobilization and indigeneity. The need of the hour is to defer to the authority of indigenous people as they take up defensive strategies of self determination against ethnocide and politics prof assimilation while dismantling the cultural hegemony of eurocentric and technocentric paradigms of power as it relates to knowledge. It behooves us to create systems of engagement that restore autonomy to indigenous people in matters of decision making regarding their indigenous knowledge.

4

THE MEDIUM IS THE MESSAGE

JUSTIFYING A CRITICAL CONSERVATION OUTLOOK

When Goethe uttered this passing phrase, ‘if only these treasures were not so fragile as they are precious and beautiful’, his words evoke a sentiment that characterizes the atmosphere around indigenous knowledge. From the proponents of high modernism, the advocates of sustainable development, historically the scholarship about value of indigenous knowledge is succeeded by urgent appeals to secure its protection. Having undergone their metamorphosis into risk societies (Beck, 1992) Indigenous cultures the world over, their life ways and knowledge find themselves at a precipice, one that portends a great loss. As forces of globalization increasingly demand of varying cosmologies a revision of their cultural architecture into a homogenous ideal, the culture capital invested within indigenous knowledge practices across the earth are under threat of rapid and irrevocable erosion. The loss of elders, unprecedented scales of migration, language loss, environment and habitat loss, systematic marginalization at the hands of government, regimes of extraction, acute poverty are only some of the forces that threaten the cultural erosion of indigenous knowledge today.

The forces that threaten the survival of indigenous knowledge and culture has had an enduring history, with colonial origins with an ardor that hasn't diminished till the present, whether it was heart wrenching policies of assimilation packaged as educative reform in North America, Canada and Australia, the extraction of natural resources, the dispossession of land, ritual artifacts and wealth, the theft and appropriation of intangible culture and knowledge. Indigenous societies remain in the same state of risk from cultural loss as they did during colonial campaigns of ethnocide. As beck reminds us, where danger lurks, the saving powers also grow. With scholarship drawing attention the threats faced by the survival of indigenous cultures, it sets in motion a commensurate interest in the conservation of indigenous knowledge. The survival for indigenous peoples demands solution that transcends the physical dimension. It is deeply entangled with the urgent charge of protecting, preserving, and enhancing indigenous worldviews, knowledge systems, languages, and environments. A position only ratified in legalese as Article 29 of the draft UN Declaration of the Rights of Indigenous Peoples: 'Indigenous peoples are entitled to the recognition of full ownership, control and protection of their cultural and intellectual property. They have the right to special measures to control, develop and protect their sciences, technologies and cultural manifestations including human and other genetic resources, seeds, medicines, knowledge of the properties of fauna and flora, oral traditions, literatures, designs, and visual and performing arts'. By the time, The Convention for the Safeguarding of the Intangible Cultural Heritage, was adopted by UNESCO, the urgency and the need for conservation of indigenous knowledge was an incontestable claim.

While this move is certainly laudable, there are some fundamental shortcomings within the traditional conservation practices that are ill-equipped to handle the complexity inherent in addressing associations of knowledge and power that are manifest themselves when working with indigenous knowledge. I believe that a critical conservation lens provides a more valuable framework in articulating an ethics of intervention. The Discipline of Critical Conservation as it was developed in the Critical Conservation Program at the Graduate School of Design Harvard is a method of praxis and theory that addresses issues of social [in] justice through an engagement with heritage by studying the intersection of cultural meaning, power politics, identity, representation and context. It applies rigorous analysis to unpack the the frames that create historical narrative, explores the underlying concepts of power relationships embedded within social contexts to ask questions about the construction of heritage. It asks what, why and who determines what merits conserve and by dialectic response what deserves to be forgotten/destroyed, towards what end and whose benefit are decisions being made; whose history is being told; whose future is being created; who is included; and who is excluded?

Despite its relatively new position as an inchoate subset within the conservation discipline, a critical conservation framework can help address the contradictions inherent in the advocacy of indigenous knowledge conservation propounded by high modernists and development experts alike (proponents of dualistic thinking as explicated above). As demonstrated previously, In assessing that such knowledge contains utilitarian value and is at risk of cultural erosion, in enlists the conservation objective in service of future development, recasting the problem as the solution. If the motivation for a critical conservation emerges independent of notions of utilitarian value (for the non-indigenous actants), it goes to show that such knowledge has inherent conservation value. It sidesteps the hammer of cultural hegemony that ranks some cultures worthy of salvage over others and resists the reduction of the cultural horizon from turning into monocultures of mind. This kind of outlook allows communities to negotiate politics of assimilation using creative tools of conservation towards identity politics. When the motivation for conservation emerges from proponents who subscribe to binary categorizations of indigenous/scientific, traditional/modern, there is a danger is regarding indigenous knowledge as authentic in regards to its relationship with time.

The primary medium that heritage conservation works with is time. The practice of restoration attempts to swim against the current, to erase the flow of time and restore objects, practices, artifacts to a state of 'authenticity' before time's decay could set in. Alternatively the discipline of preservation seeks to arrest the flow of time while conservation modus operandi is to orchestrate time's passage. Critical conservation espouses a 'creative' conservation that enables cultures to gracefully negotiate change, to retain their cultural identity while stepping firmly into the future, rather than to only revere the past and ensure its static continuity. As metaphors transcend the realm of discourse to float forms of organization in the material realm, how does a knowledge that frozen in an 'authentic' state navigate change? In negotiating time, knowledge transforms alongside its constituent ecology. It loses its evolutionary capability when it becomes a fixed part in an unchanging whole? If one applies the framework of traditional conservation with its focus on authenticity, knowledge can become scribed in time as a singular performance, moored in an authentic moment of 'perfection'. However a critical conservation intent can unleash the artifact in question from occupying a monolithic meaning, but can be set into play to occupy multiple temporal manifestations. (Lowenthal, 1989) It allows for a flexibility in mediating the method of encounter, and reveals value in nested cycles of temporality. This reimagines the mandate of critical conservation from being a discipline that binds time's arrow into a method for mediating change. If conservation's agenda is to effectuate fluid thresholds between the present and the future, it is tasked with the design of the liminal, a holding ground, a congealing of time through which to expand the instant through a mediation of materiality and form and thus release the present into the future. Allowing conservation methodology to segue from resilience towards adaptation.

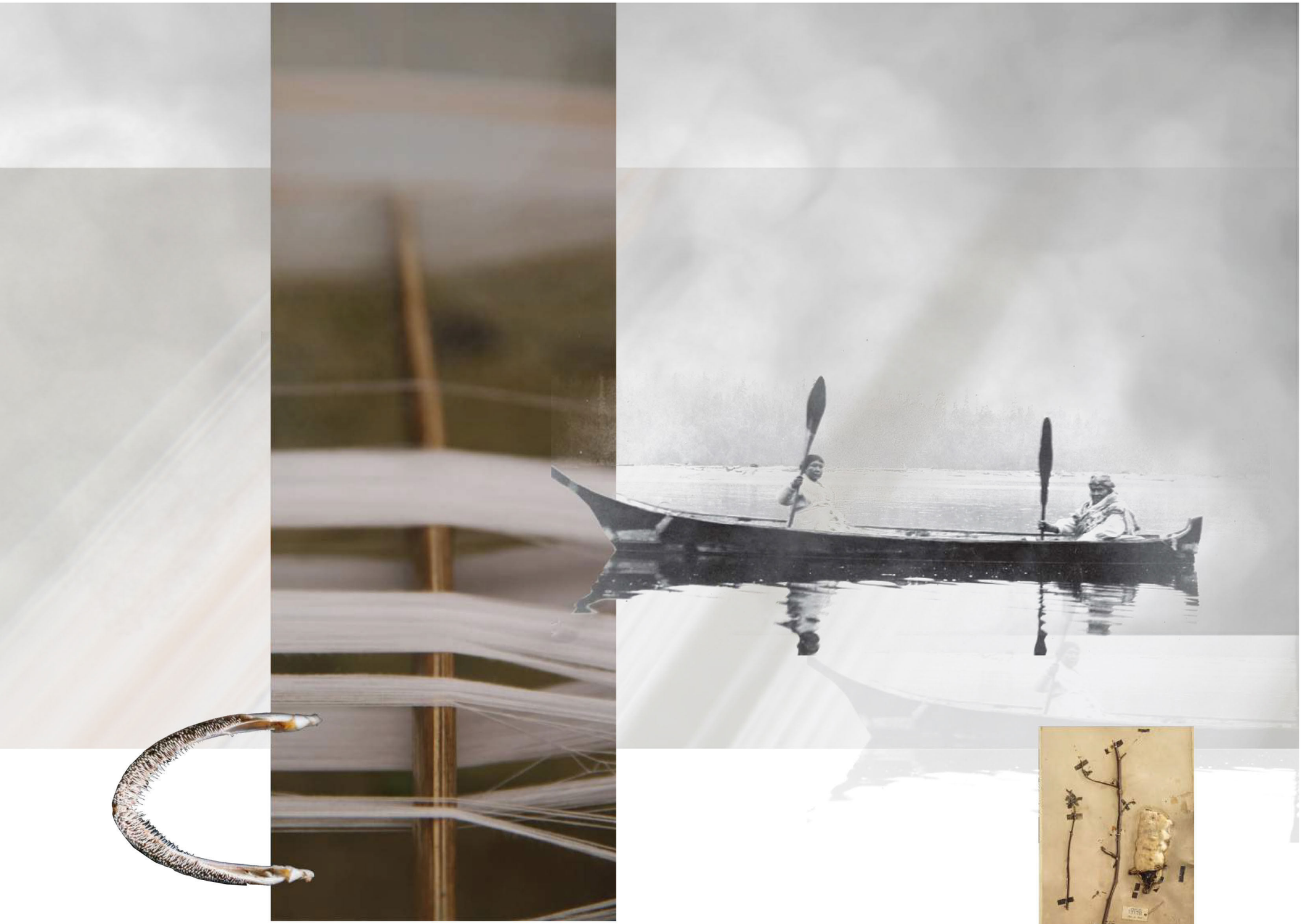
The notion that indigenous knowledge signifies static systems that remains outside history obscures the implicit power relations that constitute different forms of knowledge and of the entanglements and contestation between them. What a critical conservation intent can do is to reveal diversity of self interest among indigenous actors even as it reveals diversity in knowledge, by recognizing the inherent plurality embedded in the term ‘indigenous’ and articulate a political challenge of authority and rights as a didactic challenge in uncovering undocumented indigenous knowledge (Dove 2000). By examining the distribution of power within a system, how it comes to be exercised, by whom and how it manifests social change. allows us to move away from inflexible ideas of what constitutes opposing agendas/politics and divert attention towards radical strategies that enable a common front (Agarwal, 2005)

II

EX SITU CONSERVATION: A CRITIQUE

In much the same way as biologists over the last century strove to conserve biodiversity, through off site protection of seeds and plant clippings, Indigenous knowledge conservation has traditionally focused its attention on ex-situ strategies of i.e.,extraction, isolation, documentation , storage and protection through international, regional and national archives. Theorists and practitioners alike traditionally champion such practices (Brokensha et al.,1980; Ulluwishewa, 1993; Warren, 1989; Warren et al., 1993), and they remain popular the world over perhaps owing to their relative technical simplicity and the inherent ability to disengage in meaningful political activism. However practices of ex-situ conservation fail to respond the challenge of a critical conservation across several lines. The diaphanous Dhaka muslin offers an illuminating example.

Fig 3: Dhaka Muslin
Mixed Media Collage



The muslin weavers of Bangladesh constitute a small indigenous community that dots the coastline where the land dissolves into the sea. Their identities however, are born from the mist. Intense humidity and high moisture is necessary to weave the softest muslin. The upper jaws of a catfish with its innumerable razor-sharp teeth were used to comb and prepare the cotton before weaving. The Tribes would then equip their boats with looms and depart to seek the fog. As the mist descended over water and weaves alike did the work begin. The most delicate, the very lightest of fibers were spun into muslin thread, by using a dhunkar, a bamboo bow tautly strung with catgut. As the bow strummed across the fibers, the distinctive ring caused the lightest fleece to separate from the heavier fibers and rise into this air and it was this rhythm that set the cadence to spin muslin out of air. The mist gives birth to the weavers and the cloth, and the tribe gives birth to the mist. The conservation of culture demands the conservation of the generative conditions that allowed its emergence. How does one conserve the craft's culture, without a simultaneous conservation of the culture's constitutive community and its environment? An ex-situ conservation intervention here would result in conserving the artifacts, the loom, the dhunkar, the catfish jaw combs for preservation in museum. Perhaps it might record the practices of weaving, the craft knowledge embedded within the communities. This method however will extract, isolate, remove, translate and transform this communities knowledge and transfer it for storage and protect well outside the context from which it emerged.

If indigenous knowledge draws its vitality from being place based and from being radically intimate (Raffles, 2002), ex-situ conservation measures trip over a host of paradoxes in being methodologically suitable. The inherent dynamism such forms of knowledge and its changing character presents another challenge to the method of ex-situ conservation. If Western science is criticized for being tone deaf to local articulations, and removed from the immediacy of people's lives, then centralized strategies of storage and management of indigenous knowledges is also laid bare to the same censure. Most theorists propose the valorization of indigenous knowledge through the scientific method. (Massaquoi, 1993; Rajan and Sethuraman, 1993; Richards, 1980). The merit of such forms of knowledge lies in their evolution as alternative ontologies of scholarship, by adopting strategies and process that demand a centralization of management, to eventually be subjected to a litmus test of scientific validation suggests a bitter irony at best.

More often than not Ex-situ conservation takes the form of databases and archives. The creation of databases to ameliorate the significant and imminent risk of losing Indigenous knowledge within which may lay hidden knowledge that could be incredibly useful for the future. A range of different institutional scales of ex-situ conservation exist in creating databases for conservation. From international agencies like UNESCO and the World Bank to civil society conservation action, databases can largely be classified as having two objectives. The first is protection: they are created to protect indigenous knowledge against a risk of cultural erosion from threats and pressures of the modernizing world. The second is the analysis to identify specific information from within cultural heritage that can be then generalized for future application in development and conservation contexts. A chief critique leveled against such strategies is that they succeed in creating mausoleums, a process of entombing rather than the preservation of living knowledge. (Agarwal, 2005) The use of the term mausoleum is interesting, as if alluding to the invisible politick by which indigenous people and their culture become relegated to the backwaters of time, their knowledge operating as if it were already a historical artifact rather than living persistent enduring practices operating through polices of dissent.

Such strategies have been successful in extracting and unearthing information, a success that aids those constituencies that have historically occupied the echelons of the elite, the rich, the powerful the entitled. Among the rhetoric of 'use', there is a also this bitter pill, that once knowledge has been extracted from indigenous people and saved, there remains little motivation among more powerful constituencies to protect indigenous people themselves. Documentation and conservation is a nuanced process, which might inadvertently result in mobilizing resources away from the addressing and transforming power relations, or result in the appropriation of such knowledge by more influential social actors. Knowledge that comes to stored in databases rarely come to play a role for the poor, the oppressed or the marginalized. (Agarwal,2002) It also accomplishes a process of translation that robs indigenous stewards of their right to authorship and can sometimes disregard the politics of ownership that accompany indigenous knowledge. The medium therefore in its adherence to pragmatism practically flattens the diversity of knowledge that is characteristic of indigenous forms. In doing so it misconstrues the very characteristic of indiginaeity that render such knowledge indigenous. In extracting specific parts knowledge from the milieu of its production, then subjecting it to a transposition of a radically different environment into a translation as a fact mutes culturally produced forms of knowing and experiencing knowledge.

III

DATABASES AND THE MECHANICS OF SCIENTIZATION

The medium is indeed the message. The entangled relationship between data, representation and graphical integrity as it reveals the underlying systems architecture has now been made apparent by scholars in the design domain like Edward Tufte. In the particular case of indigenous knowledge conservation, databases as a method of represention present a graphical integrity to the colonizing mission of scientization. There exists a deep commensurability between the actions of extractive, exclusionary, translating and universalizing logic of the graphic form that a database assumes, and the mechanics of scientization that the data/content/knowledge is subject to, in order to finally arrive inside a database.

Consider the example of Neem, the Todas of the Nilgiris are only one of the several hundreds of communities and stakeholders in India who possess intimate knowledge of Neem (Azadirachta indica). Embedded within their ethnobotanical knowledge are several folk narratives that feature the neem spirit, as resident goddess that inhabits the neem tree, these stories describe the neem goddesses' friendship with a rat and their adventures and play during the summer, a story of how she was reborn in fire, where she discovered her ability to heal , another that describes her tearing off a piece of her robe to bring back a statue to life and such other vivid articulations in narrative. These narrations are dispensed orally as stories across firesides or pillow talk, between grandparents and grandchildren or shared by young friends who descend into the forest together. They emerge, as Hugh Raffles describes from a radical intimacy with place and its constituent species. For the scientist or researcher who encounters these narratives, the organizing principle of the scientific method which he is committed to, will demand that only that part of this narrative that is useful be valorized. In extracting a single aspect of this narrative, it demands the simultaneous discarding of other knowledges, practices, milieu, context and cultural beliefs that are its mis-en scene. Agarwal calls this identification and separation of useful knowledge, 'particularization'. Since this process is enacted only in response to components that are 'useful' as a resource, the knowledge has no claims outside of this prescribed role to marshal powerful support.

This extract now demands a translation it into the language of secular science. This particularized knowledge needs to be tested and validated by the scientific method. Validation provides a graphical impetus, in that it makes this knowledge ready for inclusion in a database. Only the useful elements are abstracted, rituals, gestures and other embodied accompaniments that were culturally administered with a medicinal preparation, in this case the neem have no place in the tabular logic that is most databases. Now ready to be catalogued, archived and circulated, this knowledge can be put to use. These processes are described by Agarwal as generalization. Latour explores these processes vividly of how scientists create "order to the jungle of scientific practice." His ethnographic observation while trailing a group of soil scientists across the amazon, leads him to conclude how a translation occurs through scientific processes of measuring and sampling that discards"locality, particularity, materiality, multiplicity, and continuity" in favor of "compatibility, standardization, text, calculation, circulation, and relative universality." (Latour, 1986) In placing the term neem in one tab and antiseptic in a corresponding tab, the near surgical precision of the excel sheet as a graphical methods shears all of its useless aspects of the cultural mis-en-scene. The crux of a tabular representation rests on the homogeneity and consistency across variables. That all cases within it will be describable precisely based on the variables that the makers of the database deem relevant. There is an inherent tendencies of databases to discriminate against all forms of indigenous knowledge that cannot be described as a cause and effect relationship, thereby flattening that diversity that makes indigenous knowledge so critical. (Agarwal, 2002)The graphic method thus reproduces in commensurate response the very mechanics of scientisation.

IV

THE POLITICS OF REPRESENTATION

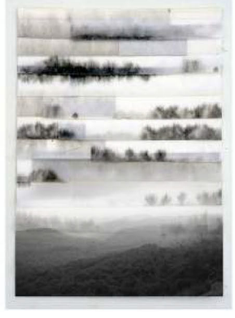
Spivak's 'Can the Subaltern Speak?', was an inaugurating moment in subaltern studies with powerful significance for indigenous studies. Spivak contends that the necessarily Western perspective of post-colonial studies serves to silence the third world 'Other'. She traces the silenced voice of the other, its historical muteness as a result of the processes by which the discipline of postcolonial studies paradoxically inscribe, co-opt, and rehearse neo-colonial imperatives of political domination, economic exploitation, and cultural erasure. To apply this lens to the domain of indigenous knowledge particularly from the motivations of development actors, reveals that one rarely enters the testament of the indigenous's voice consciousness, the processes of scientization described above, despite how realistic or useful , are merely representations created and framed by a western perspective. Remembering Latour's assertion of science as a colonizing force, now a rupture emerges , dividing the 'true' knowledge of those colonized and the myriad invented representations by the colonizer. In terms of power alone, the western perspective is painted as vastly superior to that of the subaltern, offering a voice in the chorus for those with the power to speak for those who cannot.

Though emerging from the context of a global south, or in Gramsci's case, using the military term 'subaltern' in reference to asymmetric national development, indigenous critical theory emerging from the west, that interrogates the concept of indigeneity may share much resonance to the notions subalternity by postcolonial thinkers. The focus on systemic silencing of the indigenous or the subaltern voice by extension leads us 'to cast doubt on the benevolence of the 'information retrieval' technologies of the colonial and neocolonial powers including those technologies of knowledge deployed by apparently sympathetic scholars and activists.' (Byrd & Rothberg, 2011) and draws focus on structures that contribute to our inability to hear voices from the margin. The political stake of listening to the subaltern/indigenous voice is co-mingled with the transformation of the conditions of reception of the voice. By non reception, it refers to the entire gamut, of radical apathy, a relegation to silence, absence and non recognition, or even more dangerous a partial reception whose bandwidth of listening extends derives from power hierarchies. Hegemonic powers, have had a history of partial listening to subalterns in matters of surveillance, subjugation, bio-piracy or consumption. It becomes crucial therefore to investigate how various medium entrust power to speak over those that cannot, and the influence to listen. (Byrd & Rothberg, 2011) Two anecdotal instances come to mind. In the first, I recall the palpable frustration of a professor writing about land policies in western India. Despite being a theorist of great acclaim, she spoke about the frustration of needing to build her theoretical foundation off the works of white male academics whose intimacy with the subject matter was far less superior to her own. The second instance was a stray comment made by a indigenous female scholar about her attempts to engage with the discipline of indigenous studies. She described a small revolution taking place in the discipline of critical indigenous studies using twitter. To avoid circulating reference from non-indigenous scholars, she described the processes by which tweets, were crafted and co-opted by indigenous scholars into the academic canon to truly engage the indigenous voice.

It is therefore of critical importance to consider the history of the politics of assimilation, the historical silencing, the mechanics of non recognition that are embedded with the notions of indigeneity and the subalterns, and therefore crucial to consider as a design principle practices of in situ conservation that recognize and defer to maintaining the first voice (Galla, 2008). In the particular case of indigenous knowledge, it also becomes particularly important to consider the politics of ownership and the genius loci embedded with in.

5

DESIGNING FOR THE NON DUAL MIND



IDENTIFYING STAKEHOLDERS

The System Architecture Framework unfolds in a 6 step process: Describe the Context at several scales, Identify and categorize Stakeholders, Describe Stakeholder Needs and Desired Outcomes, Identify Desired System Objectives, Describe current Functions and Form, Describe proposed Functions and Forms and evaluate them according to the System Objectives. Having begun the design of the tool in a systems architecture class, I began the design process using the guiding principles of steps 1 and 2 by Identifying stakeholders and describing the desired functions and objectives for SCRIBE. As a robust method of describing and visualizing, it provided me with a theoretical foundation within which to launch the investigation. It is important to pause here and consider that this method has its origins in the military industrial complex, a force that has led to conflict and injustice among indigenous people and that there is a certain bittersweet quality in employing tools drawn from this history and context to target a solution to this self same problem of injustice.

The Design of SCRIBE as a platform/mobile application to enable in-situ conservation of indigenous knowledge followed a traditional design process. The first stage was to map the stakeholders or users of the application. With the objective of being used by a range of different profiles of people. Scribe is meant to cater to a diversity of users and stakeholders. They can be loosely categorized across three rubrics:

1. Primary: Indigenous community members, Knowledge protectors

2. Secondary: Conservationists, Researchers, Academics, Policy makers.

3. Tertiary: National and International Institutions associated with Indigenous knowledge conservation. i.e Ministry of Culture, National Archives, UNESCO.

The categorization of stakeholders is a concept that is shared by several disciplines from development to conservation, it may be of note to pause and reflect on how a systems architecture framework presents a nuanced tool for describing the various hierarchies of stakeholders based on where the system boundary is drawn. In this case, if one were to consider SCRIBE from a users perspective, then community members remain primary stakeholders, but if one were to consider SCRIBE solely as a design based agenda, the system country shifts, and designer becomes the primary stakeholder, while the communities become tertiary stakeholders.

IDENTIFYING DESIRED FUNCTIONS AND OBJECTIVES

The desired fuctions and objectives of SCRIBE are:

1. Documentation (for Primary, secondary and Tertiary stakeholders)

Passed down from mouth to ear, in an unbroken line stretching centuries into the past is a veritable treasure of oral traditions, folk practices and intimate knowledge, a significant percentage of which has never yet been written down or recorded. SCRIBE should enable comprehensive and systematic documentation that honors local specificity, the tacit nature of the traditional knowledge in a transparent manner with prior and informed consent of the stakeholders. The design should consider that documentation will necessarily be fragmented, arriving from several different voices within the community, and consider how to make discrete parts from a boundless whole.

2. Preservation (for Primary, Secondary and Tertiary stakeholders)

We are at a precipice. With the loss of elders, in the span of a generation or two, we stand to lose centuries of accumulated knowledge in one fell swoop. Indigenous knowledge is at incredible risk of erosion, with increasing globalization, high rates of assimilation, weakening of ancestral customs, livelihoods and traditional knowledge systems and a rapidly changing environment. The safeguarding and preservation of such intangible heritage is a critical objective. SCRIBE should enable sensitive management of documentation efforts such that protection and preservation can be mutually reinforcing for the benefit of future generations.

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3. Capacity building: Training in documentation techniques (for Primary, Secondary and Tertiary stakeholders)

One of the pitfalls inherent in the documentation of traditional knowledge is that of intellectual property rights. A crucial step in the documentation process is the recording, or “fixation”, of the Traditional Knowledge (TK) in a material form or when TK is transferred from one medium to another. This recording or fixation is often the point at which intellectual property rights come into existence. In such instances copyright does not protect ideas or knowledge as such, but rather the form in which they are expressed. Therefore a critical aspect of SCRIBE should be defensive intellectual property protection through training and ensuring that community partners are protected by using documentation methods and techniques and the use of technology that establishing positive rights in relation to their traditional knowledge. An important distinction here is the difference between capability building as a measurable indicator and capacity building, which is often a catch all term used in development projects. Drawing from Dr. Wood’s extensive work in the realm of capability building (Wood, 2012) as the ethic that underlies the projects undertaken by Space Enabled Group.

4. Enable indigenous agency (for Primary, Secondary and Tertiary stakeholders)

By using tools and techniques, that enable indigenous self representation, and retain indigenous agency in the dissemination of their own cultural narrative and cosmologies, SCRIBE's objective is to preserve the first voice and facilitate indigenous agency. A critical goal of scribe is to develop and establish a community authentication process. This is important because it is a complex task to develop a process or procedures by which to authorize or verify the information included that the whole community recognizes. Since indigenous knowledge is shared knowledge, it doesn't necessarily map to notions of individual(s) intellectual property rights.

5. Protection against misappropriation. (for Primary, Secondary and Tertiary stakeholders)

SCRIBE should be designed to be sensitive to the misappropriation that indigenous knowledge has historically been subject to. Positive protection against misappropriation especially considering the ease with which digital content, can be plagiarized, altered, or divorced from context. It should also demonstrate sensitivity in representing potentially offensive or upsetting material. Indigenous practices emerging as they do from specific ontologies may be unfamiliar to outside perceptions. Having experienced negative consequences from the imbalance of trade in cultural knowledge and resources, SCRIBE will be designed to protect communities digital content.

6. Allow for varying levels of special access (for Primary stakeholders)

SCRIBE will be designed to have varying levels of access to special content based on community deliberation, such as password-protected access to sacred or secret knowledge in order to prevent widespread access to information that has the potential to make a community vulnerable. Communities will retain agency and control access to sacred or secret information, digital or otherwise.

7. Knowledge exchange (for Primary, Secondary and Tertiary stakeholders)

SCRIBE should be designed to facilitate knowledge exchange, dialogue, collaborative research and development between scientific and artistic communities and indigenous partners in a mutually respectful manner that is deeply sensitive to any underlying power asymmetries.

8. Explore alternate media (for Primary, Secondary and Tertiary stakeholders)

Traditionally large scale documentation efforts employ the use of banal media. SCRIBE will have the opportunity to host alternate media like Virtual Reality, augmented reality and harness the expressive capacity of the arts not only to document indigenous knowledge but also to creatively conserve.

9. Education and Outreach (for Primary, Secondary and Tertiary stakeholders)

With a heavy emphasis on the quality of the output (of the documentation) the final media can be used for outreach that target community-oriented objectives (education, awareness raising, cultural preservation, etc.) on one hand, and the public and policy arena on the other.

10. Economic support (for Primary stakeholders)

A key objective of SCRIBE is to ensure that it does not become extractive.i.e. taking knowledge from the community without remuneration in kind, therefore a key objective of this project is consider (in future iterations) how to supplement economy, stimulate livelihoods and give back to the community economically even at a small scale.

III

INITIAL DESIGN OF SCRIBE

A video demonstration of the SCRIBE app and its constitutive functions, can be found in Appendix A. It is recommended that the reader view the video, rather than read this section. The following description is for readers who do not have access to the appendix.

Scribe is designed as a tool to enable various profiles of users to document and record indigenous knowledge. It is designed with several layers of protection with deference to community ownership of digitally transcribed knowledge. The app opens with a comprehensive list of ethics and guidelines we want our users to adhere to as part of the terms and conditions for its use. Each new user must complete a training video and a small exam to begin scribing. The training videos are designed based on best practices from UNESCO conventions on safeguarding cultural heritage and World Intellectual property organization's guidelines for the same. There are 4 different ways to record data available within the app, uploading or shooting images, audio recordings, video, or a 360 degree video for virtual reality environments. Media can be uploaded or shot in real time. All projects/data that is uploaded will be listed with collaborators, this is a feature to ensure that there is a community member always associated with every single data entry point. This is an important feature to establish the communities's rights to their knowledge. Once the media is uploaded, the app will reveal a project page which contains various other information about the project, its description, geolocation, tags and the like and this landing page prepare it to be published. Each post has several different privacy settings. Every single post needs permission from the community partner to be published. Upon request permission from a community partner to publish, files, text messages can be shared with your selected community partner until they offer consent to publish. This page establishes positive intellectual property protection. The app offers community verification of information. All tags are geolocated as well as tagged with keywords. SCRIBE is also designed to search and show various other forms of data that co-relate to a specific entry, for example, if one were to document root bridges in Meghalaya, a search result would show up all the SCRIBE posts relating to the root bridges, but also the scientific papers, GIS data on the same subject. In accreting or entangling together two models of knowing that rarely have a chance to engage in a dialogue, SCRIBE espouses a non dualistic gaze.

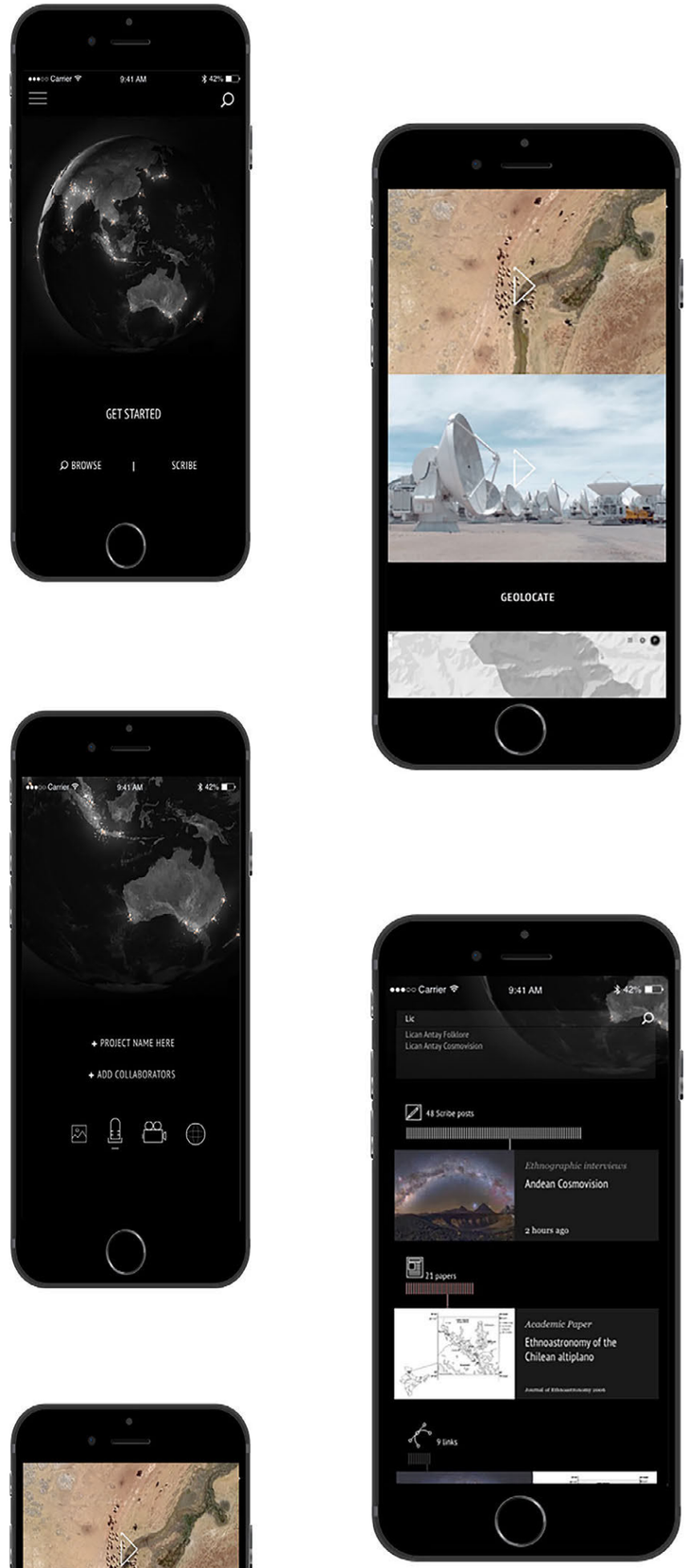

Fig 4: Screenshots of the SCRIBE app
Please refer to appendix A

IV

A CASE STUDY IN CHILE: ANDEAN COSMOVISION

I.V.I

MOTIVATIONS:
THE MYTH OF THE COSMOS PROJECT

The Myths of the cosmos is a project undertaken by the Space Exploration Initiative at the Media Lab to document and explore the alternative cultural ontologies relating to the stars, the cosmos other dimensions, and extended voyages that can shape the discourse for a more inclusive and diverse mythology of future space exploration.

Well before Quintus Ennius, in 169 BC said, 'No one regards what is before his feet; we all gaze at the stars', civilizations scattered across the earth had their eyes turned skyward, asking of its vast canvas mysterious questions, and receiving in return, answers that would go on to birth entire cosmologies. More than two millennia ago in 164 BCE, a discerning hand carved the passage of Haley's Comet in Cuneiform on a clay tablet in Babylon, the same wonder perhaps guided another hand in a cave in Kashmir in recording the earliest known depiction of a supernova, nearly three thousand years ago. In Chile, the nomadic Andean ancestors scripted shadows to transcribe the passage of sun in pulsing rhythm to their Llama herd's fertility cycles, in Aotearea, the voyagers set out to sail the great oceans using celestial navigation, they consulted pinpricked star maps through their song. These are only a few examples of how the blanket expanse of deep space has enchanted the cultural imagination of nearly every civilization on earth, how its vast scale has become the fountainhead of creation mythology for sky-bound minds inhabiting earthbound cultures. Indeed, it is the notion of shared provenance that legitimizes every culture's equal right over the territory of space and yet, not every culture has equal access to the cosmos.

Img 5: Indigenous Cosmology
Mixed Media collage

The history of astronomy is a history of receding horizons but the horizon is no monolithic constant. It remains a jagged line from the perspective of space exploration and access. For some countries and corporations the frontier of space is familiar territory armed as they are with significant resources and infrastructure to have become veteran voyagers; others take nascent steps, developing strategies to strengthen their space programs; and yet others, communities and nations remain, with their feet planted firmly on the ground, gazing at the horizon that never moved, exploring the deep expanse of the cosmos through myth, language, ritual and dreamscape. Indigenous people have been invested in the cosmos, long before the historical arrival of nations or corporations, but they are written out of the very discourse on space exploration. Despite this marginalization, they remain explorers of the incredible mystery that animate our skies through rich cultural cosmologies evolved over millennia of observation. Their knowledge represents diverse ontologies that offer insight into radically different relationships that humans have evolved with space and its exploration and is a fount of intangible heritage that rarely makes an appearance in the mainstream discourses on space and its exploration.

If one were to categorize the motivations that are often cited for space exploration, five recurring themes emerge. Chief among them, and arguably the most worthy, is the scientific quest for knowledge and the ennobling curiosity and wonder that is at the heart of the human imagination spurring us to unravel the mystery that is the great unknown. The second reason, is extraction. A single collision of two neutron stars forges gold worth about 100 octillion dollars at today's market price, or $10 0,000,000,000,000,000,000,000,000[9] (written out 1 followed by 29 zeroes). The lure of precious metals like gold and platinum and yet more rare and undiscovered elements, ripe for the taking is seeing a surge of asteroid trillionares, with their eyes on the horizon. Another motivation is industrialization, where the special environmental properties of space become the fertile soil for commerce, manufacturing and industry. The fourth reason is expanded re-territorialization, with climate change, the territory is shrinking on earth in a very real sense with resources reaching exhaustion, we seek to take to skies seeking alternative real estate, an evolutionary leap that will allow our species to become at last; space faring. Last among the motivations, but truly not the least, is colonization. The justification of colonization is not concealed under the artifice of language; space exploration today is unabashedly recycling the parlance of previous colonial endeavors in its brazen use of terms like 'settlement', 'conquest', 'progress', 'development' and 'discovery'. Such terms are loaded with hegemonic undertones and allude to deeply entrenched colonial attitudes even if the motivations for space travel are more expansive than the language describing it. Space exploration is thus linked deeply to climate change and its colonial legacy. There is an incredible opportunity here to humbly listen to wealth of knowledge embedded among indigenous people, the survivors of the violence of the colonial endeavor, to give voice to their wisdom and learn from their experiences of marginalization as well as the incredible wealth that is their cosmology in order to shape a diverse future that speaks to a shared right to the cosmos.

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9 https://www.businessinsider.com/how-much-gold-created-in-neutron-star-collision-2017-10?r=US&IR=T

As humans become prominent actors in extraterrestrial realms, it stirs in our wake complex questions of identity. Whose identity becomes a blueprint for 'humanity'? What cultures are represented? What others are silenced by deliberate obscuration or worse by ignorance and apathy? In the history of space travel there have been less than 600 people who have left the earth's atmosphere. With an overwhelming majority of these being white, male, and caucasian, space travelers boast a poverty of diversity in racial, social and cultural heterogeneity. With only 14 African Americans, 11 Muslims and only 1 Native American to have ever left the earth's orbit, there is a prevailing pattern of homogeneity reflected in the bodies and identities of the average space traveller. Despite their rich heritage of ethno-astronomical knowledge, there has never been a Maori in space, never been a Zuni, never been a Kayapo, never been a Dalit in space. Despite the physical advantage that might predispose them to maneuvering in zero gravity environments, there has never been a deaf person in space. The world has never known a transgender astronaut, no publicly identifying LGBTQ astronaut. If this narrow sliver of human identity comes to stand in as figureheads for the spectrum of human identity in a new era of space exploration, how truly does this encapsulate a history that reflects a global consensus? Indeed what does it portend for the future of human identity in outer space?

Mary young, an anthropologist working with Inuit peoples in Alaska records a small anecdote in her field notes: "When I told them about the first moon shot, and of astronauts now walking on the surface of the moon. The Inuits began laughing, and when I inquired why, they replied: 'We didn't know this was the first time you white people had been to the moon. Our shamans have been going for years. They go all the time.' The woman who told this story added, 'We do go to visit the moon and moon people all the time. The issue is not whether we go to visit our relatives, but how we treat them and their homeland when we go."

Embedded within these communities, are insights that can radically shape humanity's future in space, and have profound implications for how we live in reciprocity with the earth and the cosmos. The Myths of the cosmos project seeks to explore such storied cultural heritage preserved in Indigenous Communities, by documenting and preserving the rich intangible heritage of star knowledge, mythology and cultural cosmology held by indigenous cultures the world over.

I.V.II

DOCUMENTING THE LIKAN ANTAY COSMOVISON

In Alero Taira, lies an incredible natural observatory, the river Loa cuts through the Atacama Desert in Chile, and nestled among the undulating river are small rock pools. With the glittering night sky above, this magnificent setting is a natural observatory, the ancestors of the Likan Antay, the andean people used to come to this site and peer into the reflecting pool to see their corresponding constellations. The Incan constellations are dark constellations, they are the negative spaces formed by absence of swirling dust clouds in milky way. The andean cosmovison believes that these represent the silhouettes of animals that came to drink from the waters of the celestial river, 'Mayu', thereby obscuring its heavenly glow. Yacana, the llama still tethered to her child through her umbilical cord, Mach'acuay- the serpent, Hanp'atu the Toad, Atoq the fox and Yutu- the ground partridge. There are seven reflecting pools in the observatory and seven constellations in the sky. The stories too, that stem from this culture are incredible, the elders say, 'The water here is old, fossil water that never entered the water cycle. Every year, Yacana, the llama in the sky, comes here to drink this ancient water. After drinking her fill, she lays down to rest the earth for a night and in the dawn before the blush has reclaimed the night, she turns into a bird and flies away. Yacana's return is essential for the Likan Antay, her arrival rests the earth and begins the annual cycle of birth and decay. If she doesn't come'; the elders say, 'it will bring about the the great unravelling.' These days, the elders wonder, what it means, the great unravelling. As light pollution obscures the night sky, the milky way is no longer visible in the Atacama desert the way it once was, and the elders wonder, is the great unravelling already here? Is it climate change?

This is one of the stories narrated to us by Dr. José Berenguer, Archaeologist, Chief Curator, Museo Chileno de Arte Precolombino on site in Alero Taira, in San Pedro Atacama, Chile. During a yet nascent stage of this thesis research, I had the opportunity to travel to Chile to document the Andean ethnoastronomy and cosmovision. The sudden blossoming of the this opportunity as well as a lack of cultural familiarity, did not provide a deep opportunity to establish community partnerships, nor consider modes of participative documentation,. What it did offer was the generous opportunity to access secondary data from the archives of the Museo Chileno de Arte Precolombino to construct a documentary record of the Andean cosmovison. We established a partnership with the Museum, and Dr. José Berenguer served as our chief contact with various community members.

Img 6: A scene from the documentation process, Dr. José Berenguer describing the significance of the rock art under the Likan Antay Cosmovision, in Taira, Chile

Img 6: A scene from the documentation process, recording interviews at ALMA, Chile.

Img 7,8: Sreenshots from the documentation film.
Refer to Appendix B to see the film.

Img 9,10: Screenshots from the documentation film. Refer to Appendix B to see the film.

Img 11,12: Screenshots from the documentation film. Refer to Appendix B to see the film.

Then there is a heap of five stars

There are many animals that are drawn in the sky.

Img 13,14: Screenshots from the documentation film. Refer to Appendix B to see the film.

Img 15,16: Screenshots from the documentation film. Refer to Appendix B to see the film.

Cultural unfamiliarity, lack of access to community networks, paucity of time to build enduring trust with community members, and a shortage of funding that made this particular experience a less than an ideal situation in which to conduct a documentation effort that espoused critical conservation objectives. But such constraints are more probable than not and likely plague research efforts often. Most research and documentation efforts unfold under similar constraints. This experience offered invaluable insight on understanding how to gather secondary data. A partnership with experts who had domain experience within the cultural context as well as access to data proved invaluable. The initial recce led us to generate a video documentation, refer to **Appendix B** to view the output. Future field work within this site, will yield partnerships with the Likan Antay community and the opportunity for in-situ conservation.

6

IN SITU DOCUMENTATION:

A Case study among the Khasis of Meghalaya

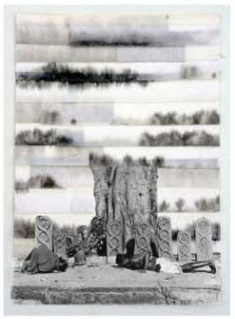
A PORTRAIT OF THE STAKEHOLDERS

One of the more prominent tribes of North east India, the Khasi dwell in the state of Meghalaya and are spread across the East and west Khasi hills, Ri bhoi and Jaintia hills. Primarily a mountainous people with a unique culture, language and identity, they have earned according to the Khasi author,R.T Rymbai the distinction of being an island onto themselves. Their have animistic beliefs and they draw their incredible nuanced cosmology from Ka Niam Khasi, their religion. They are matrilineal society and boast a complex political life that is deftly woven into their socio-cultural and religious organization. They have a rich oral culture with complex mythology , stories and and folklore which is perhaps co-related to the absence of a written script. This absence, as the poet U Soso Tham has suggested strengthened the Khasi reliance on the oral tradition as the primary medium for holding history and cultural knowledge. The Khasi people are composed of several subgroups, the Nongphlang, the Pnars, the Marams and the Bhois scattered geographically across the state, despite sharing the same language and culture, these groups differ across dialects, economy, social and political organization and also ecological history. They posses a distinct political system, that can be described as a democratic monarchy, the Syiem (king) is a democratic head rather than an autocratic monarch. The political organnisaton consists of dorbars a legislative, administrative and juridical body that exists across difeferent scales, from the clan, village, region and state. Apart from being a political body, the dorbar is a moral and religious institution.

The Khasi are also famous for possessing complex knowledge of synergistic architecture. They of weaving living architecture by braiding tree roots of the Ficus Elastica into architectural structures, like bridges, platforms and stairs. Locally referred to as Jing Kieng Jri, they use these aerial roots to grow bridges that span anywhere from 10-250 ft in length. These bridges take years to grow and over 15-30 years to reach structural maturity. Owning to the mountainous terrain of Meghalaya, Khasi villages are often nestled in small hamlets deep within valleys and across waterfalls subject to ecological disturbance. Such practices of growing architectural structures present incredibly resourceful solutions to the problems stemming from being remotely located with an enduring lack of access to building material. Their origin mythology is replete with allusions to the cosmos, their origin mythology abound with stories of space travel to meet their sister tribes in the sky. Their Khasi cosmology offers compelling narrative accounts of how the tribes settled the earth, entered into kinship relations with the sky, the land, the creatures and other non-human entities. Tales of a tree whose roots sank into the very depths of the earth and whose trunk was so tall that its canopy reached the heavens, a tree that was a celestial stairway for space exploration, arising from the very navel of the earth, called Sophetbneng forms the fulcrum of their origin mythology.

Fig 17:Khasi cosmovision
Mixed Media Collage

II



STRUCTURING ALLYSHIP

The thesis goals aimed at developing a method of in-situ conservation through the crowdsourcing of indigenous knowledge and documenting oral histories and ecological knowledge. A combination of factors, the rich cosmology and community's incredible knowledge of synergistic architecture, my professional practice as a conservator and some acquaintances among the Khasi community were factors that led to the selection of the Khasis community, in Pynursula a as a case study to situate the research. At the outset of the research, under the advice of Mr. Kyntiewbor War, a respected community elder, eco-museologist, Naturalist, Explorer, Caver, Photographer and collector, I made contact with the Living Bridge Foundation, a nascent organization whose mission is the preservation of existing living root bridges, community development, environment protection, building new bridges and the protection of traditional knowledge practices. The organization is founded and led by Morningstar Khongthaw.

My early attempts at establishing a partnership within the community were severely rebuffed owning the community's previous interaction with a researcher who was studying the root bridges. Illustrating this anecdote in some detail can be illuminating in trying to understand some of the problems that emerge in engaging this type of research. The researcher[10] was non-indigenous, and the alumni of a prestigious architectural school in London whose primary interest was studying the root bridges from an architectural perspective. His association with the living bridge foundation spanned two years and they had, I was told a relationship of mutual trust, respect and shared goals. As the research itself gained international repute, and the researcher was invited to present the work in international institutes of great standing such as the Ivy leagues, or to meet with important national political actors regarding the conservation of the bridges, the community members however began to feel uncomfortable with usurpation of credit and recognition. The researcher motivated by a zeal to protect and conserve these bridges, also developed a UNESCO nomination dossier, to designate these ensemble of bridges as a World Heritage Site. Although motivated by a desire to protect these bridges which is a shared goal held by the community themselves, the nomination was done entirely without community consultation, in a process quite opaque to the stakeholders. Though there are considerable benefits that emerge from being inscribed as a World Heritage Site such as increased press, popularity, a tourism boom, access to funding among others, there proved to one drawback that was incredibly disruptive to the locals. UNESCO prescribes a number of universal requirements for the maintenance of World Heritage Sites, one of them is a buffer zone. It mandates that there can be no commercial structures within a 100 m radius of the site in question. This particular clause proved to be incredibly problematic for the locals, as several bridges were built in the thick of a village, next to homes that double up as commercial enterprises, tea shops, restaurants and places of livelihood. A designation that threatened the livelihood of the communities incensed the community members. A crucial lesson here is that both actants within this anecdote, the researcher and the community share the exact same goals, the conservation of the bridges but the power asymmetry and socio -political access embedded in their respective networks led to an outcome that threatened to dispossessed the community of their livelihood.

Acutely aware of my position, as an uninvited researcher[11] situated in an elite institution and acknowledging the underlying power relationships that characterized our relationship, I spent several weeks of my limited time in the field trying to establishing a foundation of trust with the community partner, the Living Bridge foundation. Over several semi-structured meetings we were able to agree upon mutual goals for this partnership. The Living Bridge Foundation ideologically contested research that frames them within a deficit discourse, research that is done 'on them' rather than 'with them', ensuring them that self representation was a chief motivation for the technology design was a significant first step towards building trust and securing allyship. Engaging with the community with an 'outside' project seeking to look 'inside', it was crucial to be transparent and communicate clearly my motivations for initiating this work. Although protection and conservation of community knowledge is a goal of the living bridge foundation, systematic digital documentation has not been a priority in their practice which mostly focuses on material conservation, knowledge sharing through workshops, training and community based conservation initiatives. Over a few weeks as a participant observer immersed in conservation activities under the aegis of the living bridge foundations mandate, we arrived at the following mutual goals/guidelines for our partnership

10 This anecdote is necessarily one sided and was narrated to me from the perspective of the community members

11 I use this term to refer to the research as an entity that did not originate from or wasn't solicited by community invitation

A. Protection and conservation of community knowledge.

The designation of what knowledge is valorized as meriting protection will come from the community, as a researcher I am at liberty to discuss that a certain ritual, practice, story might merit documentation, but the most ideal situation is one in which community members and individuals retain full autonomy.

B. Collaborative Design Iteration and Decision making

Although the Initial design concept was already in place before working with the living bridge foundation, future iterations would be prompted by a process of collaborative decision making and community feedback. All instances of output, whether it is presentations, papers, demos will be whetted by the community partners. In instances where the research will be presented, the foundation will be invited to speak or make a statement, and the foundation will be consulted in matters of future fundraising as it pertains to the specific research.

C. Facilitate skill sharing, knowledge transfer and introduction to networks as the research progresses depending on access.

Engaging in research with community's that have been historically economically disadvantaged can often be one sided, with the benefits accruing to the researcher alone. A long term goal for this research is to ensure that there was a mutual reciprocity in terms of skill sharing and knowledge, and facilitate the shared growth of each other's networks. For example, during a discussion with the Morningstar, the director of the foundation on how new technologies to be deployed in this context, we discussed inviting synthetic biologists to discuss how genetic modification might enable the evolution of synergistic architecture. I was able to invite a synthetic biologist to begin a cautious and respectful dialogue with the foundation.

D. Defer to the community partner in practices of community engagement

As experts situated in an intimate relationship with the community and the environment, the research defers to their insight in devising the time, organizing the method of engagement, explaining the principles of free, prior informed consent, collecting information about community members local knowledge, operating within the local context and engaging with political representatives. The partner will advice on the method of consultation with multiple levels of authority within the community, from the individual to the organizational level to adequately seek consent.

E. Defer to local knowledge and the medium of its production

The research defers to the knowledge held by the locals as significant and adopts an attitude of humbling learning from their expertise. It also assumes that intimate knowledge is an embodied entity that inherently resists any documentation, digital or analogue, no matter how comprehensive its objective. By assuming that there are aspects of knowledge held by the community that cannot be communicated, let alone documented, it aims to explore the limits of the documentation method. The research will also treat all data documented horizontally, whether primary or secondary as being equally valid regardless of 'scientific validation'

F. Maximize community control over knowledge resources.
The research will seek to develop a method that enables maximum community control over documentation, self representation but also seek to address instances of bias in representation. This is critical to ensure that there is representation from various demographics and marginalized constituencies with the community.

III

PARTICIPATORY DOCUMENTATION

What does the term ‘Participatory’ entail when it is used in conjunction with visual and digital methods of inquiry? Gubrium and Harper offer an interesting explanation, “methodologies, approaches or techniques that afford the ‘subject,’ ‘community member’ and/or ‘field site’ greater narrative latitude when it comes to ethnographic knowledge production and a larger role in determining why and how research outcomes are produced by lay and academic audiences alike.’ Participatory methods explored within this thesis include photovoice, an ethnographic method that has been hugely successful for advocacy, in which people often those who possess limited power as a result of poverty, language barriers, race, class, ethnicity, gender, culture, or other circumstances – use video and/or photo images to capture aspects of their environment and experiences and share them with others and participatory video making or collaborative documentation. (Gubrium,Harper 2016)

During this stage of documentation, I adopted a passive state of involvement, preferring to make space for the community partners voice to emerge through the process. Considering that the Living Bridge Foundation's headquarters were located in Pynursula, Morningstar and Shiningstar decided to begin with a documentation of the bridges in that geographic vicinity. They also wanted to document various stages of the bridge in terms of maturity. Though their initial impulse was to document existing bridges, over the span of two weeks they quickly shifted gears to incorporate content that focused on building new bridges. Inspired by two ongoing projects that they have within the foundation to build a school for living architecture and a project to build new bridges in the Garo hills, a constituency nearby that does not have a history of building living architecture, they considered shooting a video that explains the 'how to' of building living architecture. They also interviewed bridge-builders within the region and these interviews were extremely diverse, speaking about minutae shifts in the weather, agricultural techniques as well as living architecture. They also moved effortlessly across nested scales from the individual plant, to its ecology as well as its cosmological attributes. I did however intervene at moments, to ask them to explain something in greater depth, with questions that asked them to provide more context. It was an intreting experience to watch this process unfold in real time and watch my own response, in trying to mentally sift the data we gathered into my categories. It was a challenge to reflexively preventing myself from performing extractive vivisecting mental maneuvers, and let the logic of my design practice slip away for an organic and directed documentation undertaken largely by the community members themselves. There were instances when I had to pause though, and prompt our community partners in documenting female voices within the documentation, as an observer I had to consider how biases might play into what gets documented and what gets discarded. Since the Living Bridge Foundation is an organization that is intrinsically connected to an eco-tourism model of conservation, I wondered how much of the documentation was inward facing, for community viewing and protection and how much was generated with the objective of being outward facing, for educating outsiders through self representation of indigenous knowledge.

We conducted documentation activities across 4 villages, Pynursula Burma, Riwai and Nongriat. We visited 11 bridges in varying states of maturity and age. Morningstar Khongthow, Shiningstar Khongthow and Boldness Nongum conducted the documentation activities[12], recording practices, co-conducting interviews, documenting bridges, relying oral histories, folk narratives, stories and cosmology. Data was also collected as Audio interviews. The content that was documentation spanned a diverse range of subjects, which are loosely classified for descriptive ease into the following six categories. 1. Ecological/ Environmental/Botanical/ Conservation 2. Agricultural 3. Historical/ Cultural 4. Cosmological 5. Political 6. Commercial / Tourism.

It merits mentioning that this categorization is merely for descriptive and illustrative purposes for the thesis, and that in actuality the Khasi themselves do not subscribe to the categorization of domains of knowledge as distinct or separate.

12 The author recognizes the lack of gender and demographic diversity among the documenters as a result of resource and time constraints and hopes to address this in future research.

The living root bridge ecosystem
The ecology of ficus elastica, the rubber tree
Areca Catechu and bamboo root guidance system
Site selection and techniques of construction
Maintenance techniques
The coupled relationship between human and ficus elastica
Recollections of root bridges, location, site conditions
Community based conservation practices
Recollections on ecological memory
Historic climate sketches
Local geography, material ecology of the site
Plant/animal/fungi ecology of the bridges
Justification for building new bridges
Location specific ecology

Political ++

Demographic of villages
The Dorbar system
Autonomy and self representation in the Khasi culture
The relationship between religion and politics

Impact of tourism on livelihood
Eco-tourism as a sustainable development model

Commercial ++
Tourism ++

Cosmological ++
Ontological ++

Khasi cosmovision
Khasi conceptions of time, materiality, space
Notions of sacredness
Animism from the Khasi religious perspective
Sohpetbneng, the navel of the world, the soul tree
Spirits and beings that animate the Khasi folklore and mythology
Folktales on how the animals came to have their names
The bridge as philosophical entity in the community mind
The Khasi language and its relationship to the environment

Ecological ++
Environmental ++
Botanical ++
Conservation ++

Agricultural ++

Betel leaf agriculture
Perma culture
Jhum Agriculture
Harvest festivals

Khasi gastronomical culture
Subsistence based foraging and its changing practices
Effects of migration of indigenous knowledge loss
Differences between traditional knowledge that is the domain of men and women
Changing perception of the bridges in the community
Oral history, Rituals and festivals
Khasi Ethnoastronomy
Harvest songs

Cultural ++
Historical ++

Fig 17: Broad themes covered during documentation

Img 18,19: Screenshots from the documentation (Morningstar Khongthow demonstrates the first steps of building a living root bridge)

Img 20: Screenshots from the documentation
(A site has been selected. Giving birth to a
living root bridge)

Img 21: Screenshots from the documentation.
Akortori war discusses the differences between women's knowledge and men's knowledge in agricultural practice)

Img 22: Screenshots from the documentation
Benediction Muivah War discusses betel leaf agriculture

Img 23: Screenshots from the documentation Benediction Muivah War, a bridge builder from pynursula village dicusses the motivation and methodology of building his rootbridge.

Img 23, 24: Screenshots from the documentation Shiningstar Khongthaw demonstrates techniques for Bridge maintenence.

Img 25, 26: Screenshots from the documentation
The ficus tree has roots that demonstrate a tendency to insoculate, phenomenon in which trunks, branches or roots of two trees grow together. This quality is what makes rootbridges a structurally stable method of synergistic architecture.

Img 27,28: Screenshots from the documentation Morning star Khongthow and Shining star Khongthaw demonstrate maintenance techniques on young root bridges in Burma village.

Img 29,30: Screenshots from the documentation (Left: Morning star Khongthow documents the double laned bridge at Burma village, Right: Young root bridges in Pynursula village)

Img 30,31: Screenshots from the documentation (Left: Morning star Khongthow discusses Khasi cosmovision and folktales, Right: Varigated forms of Living architecture, the living root stairs of Nongriat village)

Img 32,33: Screenshots from the documentation (Left: Building the living root stairs, economic sharing of living root architecture amoung community members, Right: Micro ecology among the bridges, flora, fauna and fungi companion species)

Img 34,35: Screenshots from the documentation (Left: Discussion and semi structured interview between Morningstar Khongthow and Boldness Nongum on the epistemology of the bridge as a methaphor is Khasi culture. Right: Platform Maintenance)

Img 36,37: Screenshots from the documentation (Left: Boldness Nongum testing SCRIBE in Burma Village. Right: The political history and organisation of the Khasi Dorbar and its relation to living root platforms)

Img 38, 39: Screenshots from the documentation (Left: Mr.Benedict Khatsawphra discusses community based conservation practices. Right: Designing living architecture)

Img 40: Triple Decker Root Bridge, Pynursula

Post processing and post production is a significant aspect of traditional film production. In the particular case of participatory documentation or media making, projects occupy a diverse spectrum of participative engagement towards the goal of a final output. (Milne,2012) These considerations of participation may include projects that span several days to several months on production length with participants involved heavily in the editing process whereas on the other end of the spectrum are 'No editing required' projects (NER) where video production is complete after the shooting phase. Another output is the composite video, which rather than being a finished product is a compilation of snippets of visual data that acts as a reflexive tool to excavate the corpus of data and present it to the community. This aspect of data processing is an ongoing discussion with our community partners, for a community that perceives its cultural ontology as holistic, we are exploring how design of the tool can make discrete parts from a boundless whole.

7

REFLEXIVITY

SCRIBE: USER TESTING AND FEEDBACK

Beta testing of SCRIBE was conducted during fieldwork in January 2020. The tool running a limited number of features was tested on site with our community partners. This round of testing and user feedback will serve as guidelines for future iterations and design development. The testing consisted of a semi structured on boarding with six individuals from the community, where the tool was introduced and guidelines for use were explained. The participants were allowed a few days to interact with the tool of their own volition and then asked to complete two surveys in addition to giving qualitative feedback about SCRIBE. Among the qualitative feedback were responses from the participants who voiced concerns about the ease with which digital content can be plagiarized, altered, and/or removed from context. They voiced the need for further reassurances against misappropriation, a task for the design of the tool to take into consideration. A feature that the participants were pleased with was the established community authentication process, as well as the autonomy with which the community members could take charge of documentation without outside support. The participants mentioned the need for robust security and privacy of data assets. While most of the participants admitted to the value of SCRIBE in providing digital infrastructure to safeguard their heritage, they expressed severe doubts about the long term validity of the process if it failed to deliver/or be supplemented with economic incentive for the community. For vulnerable communities, conservation rarely demands immediate attention and feedback from the participants overwhelming described the need to bolster SCRIBE with an economic incentive.

Of the surveys administered to the participants, the first consisted of questions that inquired after SCRIBE's success in meeting its desired objectives. The second attempted to excavate the tool's user interface design using a Human-Computer Interface Framework for testing mobile app usability.

Fig 43: User Feedback. Survey on how well SCRIBE meets its objectives

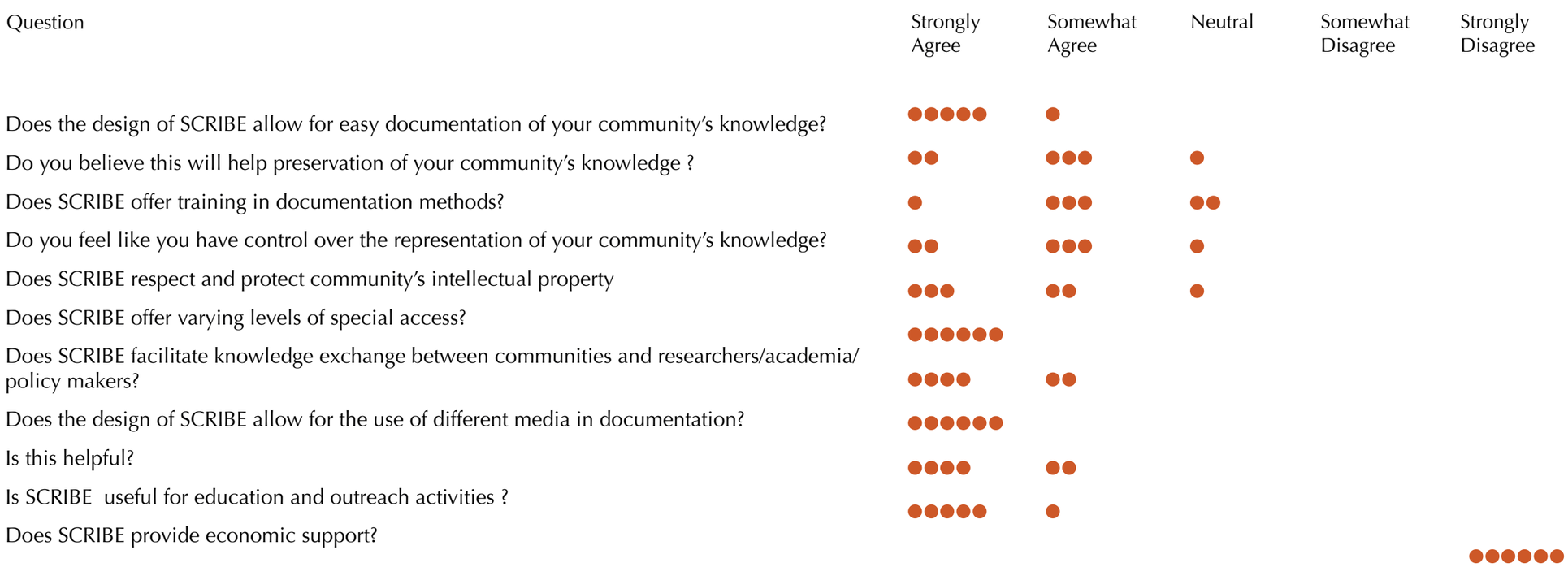


Fig 44: User Feedback on UI/UX experience of SCRIBE

Criteria	Strongly Agree	Somewhat Agree	Neutral	Somewhat Disagree	Strongly Disagree	Description
Interface Design	●●●●●	●				The design of the user interface
Design consistency	●●●●	●●				The user interface must be designed consistently
Design memorability	●●●●	●●				The user interface must be easy for users to remember how to use the mobile phone
Learnability	●●●	●●		●		The user interface must be designed for user to learn easily the use of mobile phone.
Structure principle	●●	●●	●	●		The user interface must be organized purposefully, based on clear, consistent models that are apparent and recognizable to others.
Familiarity	●●●	●●	●			The user interface must be familiar to users.
Visibility	●●	●●	●	●		The user interface should always keep users informed about what is going on, through appropriate feedback within reasonable time
Simplicity	●●●	●●	●			Make simple, common tasks simple to do, communicate simply in the user's own language
Interaction Support feedback			●●	●●●●		The user interface must keep users informed of actions or interpretations, changes of state or conditions
Error indication			●●●	●●●		The representation of errors must be clear to users
Responsiveness	●●	●●●	●			The system must respond in an appropriate time
User support recoverability	●●	●●●●				If the user makes a mistake or the application fails, the user must be able to recover the work.
Flexibility	●●●●	●●				The user interface must be flexible so that adapts to various environments and users.
User control	●●●●	●●				The users must be able to control the system by their own decisions.
Customizability	●●●●	●●				The user must be able to modify the interface in order to improve efficiency. The customizing features must be easily accessible
Performance Effectiveness	●	●●●●●				The required range of tasks must be accomplished at better than some required level of performance
Efficiency	●●●●	●●				The system should be efficient to use so that once the user has learned the system, a high level of productivity is possible.
Effort	●●●●	●●				The user interface should be designed to minimize the user's effort for using the system
			●●●●	●		

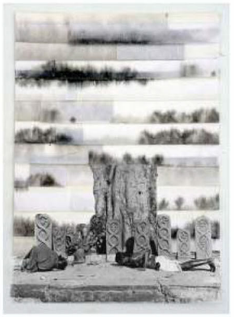
II

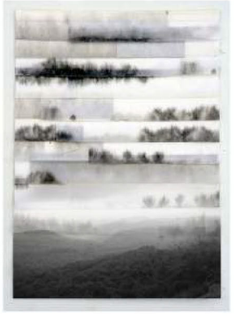
CONSIDERATIONS FOR FUTURE ITERATIONS

The design of SCRIBE will be subject to further revision and subsequent iterations will incorporate feedback derived from the first round of user testing with the Khasi community. It will be important to consider how to integrate secondary data like GIS information, earth observation data, academic papers seamlessly with the primary data inputed by the communities. Future iterations of the SCRIBE will also need focus on collections analysis and the back end. The documented data will also need to be subjected to a comprehensive analysis, verifying that the originally planned documentation objectives have been met. It will also be supplemented by secondary research from existing documents, audiovisual archives, recordings, books, databases, research theses, file archives, specialized journals, memoirs and the like. The management of the database will be need to be undertaken by trusted professionals and remain easily accessible to community members. It will demand periodic reviews of compliance with requirements for storage, maintenance and control, such as electronic safeguards and restrictions in web-based databases, in order to keep the database or register operational and, ultimately, safeguard indigenous peoples' and local communities' interests. We will need to aim to establish, wherever possible technological measures to establish ownership over the documentation, by protecting the documentation against unauthorized access by third parties, securing the content, protecting the database servers and securing the mobile application.

In considering a long term vision for SCRIBE from the perspective of conservation. It should reflect an ideological design structure of conserving fragments that are nonlinear and emergent, in which local events can manifest as global phenomena, spatially organized but disciplinarily coterminous. Rather than viewing data as a unified narrative, the design should enable an unraveling, arranging a set of disparate (data) events that are entropically emergent. Its methodology should speak to a combination of fragments that are put together in such a way that the parts are generative of a dynamic whole. Inspired by the paradigm of a creative conservation, fragments from different moments can be brought together by a designed disturbance, reordered through a creative composition to be generative of new meanings and temporalities constituted on a single digital plane; the present can becomes a binding medium on which to compose the past and the future.

III





AUTHOR REFLECTIONS

Time's arrow can birth a tornado from the flap of a butterflies wing. At the outset of this thesis, I confess, I found myself in a territory unfamiliar. The Space Enabled Group at the MIT Media Lab was about as far from my historic habitat as possible, whether it walking among the material detritus of past civilizations, or verdant lush cloud forests, or living with indigenous people and working towards a conservation objective. There is no greater force than the blanket expanse of deep space or vastness of the cosmos for a person to come face to face with the notion of scale, of your own relative position in comparison to a force so vast, and my early days in the space Enabled Group left me similarly removed. It took me a few weeks to excavate the Venn diagrams that connected my interests in indigenous cultures, my skill in conservation, design and art with the resources at MIT and the objectives of Space Enabled. Perhaps it was my presence, in the eye of the storm at the heart of technological innovation in the world, that explored how new media and technology could enable critical conservation. This is a radical departure from my usual modus operandi. The experience of having my feet firmly planted in north world's, in the shimmering burnished steel framed glass paneled atmosphere that is the Media Lab, and the rain soaked valleys of north eastern India, led me to simultaneously inhabit both worlds, both ontologies in the hope that I could become the medium. Unmoved by narratives of dualism, I have always been drawn towards practices of non-duality, in my own discipline for example in conservation, we traditionally separate the conservation of nature as independent in both principle and practice, from the conservation of culture. The opportunity to simultaneously inhabit both worlds, to seamless coalesce the intangible with the digital, to turn my gaze up at the cosmos even as my feet were planted firmly in soil was invaluable in inspiring an ideological position to ground this thesis.

It also offered me the opportunity to reflexively excavate my own identity and cultural background as the thesis progressed. As a Dalit woman who was raised ignorant of the systemic repression and historic oppression of my own community, this thesis drew me time and time again to reflect on the importance of having access to your culture's history and of the violence that is committed in severing that connection. My father's traumatic experiences of untouchability and navigating the stigma associated with caste led him to raise us oblivious of our provenance. I only learned about my own heritage well into my late twenties and its absence is a very profound presence in my life. There is power in knowledge, in self knowledge, in communal knowledge, from here identities are crafted and its loss is a profound unmooring. I am immensely grateful for this thesis in allowing me the immersion, to walk with loss and to design processes that enable finding, holding and protecting.

7

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APPENDIX A

Appendix A contains a Video Demonstration of the SCRIBE App

APPENDIX B

Appendix B contains the documentation of Indigenous cosmology of the Lichan antay people, Chile.