MATTER Journal of New Materialist Research

Universitat de Barcelona
http://revistes.ub.edu/index.php/matter/about

Remote communities, material entanglements and information and communications technologies as double agents

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DOI: https://doi.org/10.1344/jnmr.v3i2.40223

Abstract

Digital devices and Information and Communications Technology or ICT play a prominent role in most people's everyday lives, as the often unconscious, mostly unacknowledged entanglements between people, devices and infrastructure shape contemporary lives and co-determine activities and their outcomes. Communications technologies are particularly agentic for people who live in rural and remote parts of the world because they often lack easy access to goods and services that are ubiquitous in more urbanized areas. At the same time, access to ICTs in these areas is often tenuous because the maintenance of ICT infrastructure is not always economically viable.

This paper examines emerging techno-lifeworlds in remote villages in Malaysia and their social, economic and political context through a new materialist lens. I argue that the entanglements with digital technologies and the resulting diffractions can result in increased agency for those involved. At the same time as this new materialist focus emphasizes the agentic role of devices and infrastructure, it allows for thinking through the power relationships that are implicated in the regional techno-politics and the economic and political interests that determine the material access to communications infrastructure.

Keywords

Media technologies; New materialism; Agential realism; Entanglement; Sarawak.

Introduction

Access to digital devices and Information and Communications Technology or ICTs is integral to many people's everyday lives, and it is particularly important for people who live in remote areas because their relative geographical isolation often means that other communicative options are limited. In this paper I use a new materialist lens to examine the 'entanglements' (Barad, 2007) between people and devices in remote Indigenous communities in Sarawak, a state of Malaysia on the island of Borneo. I apply a 'diffractive' reading (Barad, 2007) to the changes in people's emerging techno-lifeworlds that come about as a result of their engagements with communications media, where different types of technology become embedded in social practices and embodied routines. This involves foregrounding the notion of agency in processes in which human and non-human actors including people, devices, buildings, plants and landscapes are involved, where technologies are not framed as human's 'other' but as agents that interact with other agents, both human and otherwise. This new materialist framing enables a nuanced discussion that focuses on the localized diffractions that arise where technologies are taken up. At the same time, I aim to operationalize new materialist theories to interrogate the political and economic structures and power dynamics implicated in the distribution of technologies in the region and the way this affects technology's agentic potential. In many remote areas of the world, where the provision of infrastructure is unprofitable for private companies, the existence of communications infrastructure and its continued maintenance are contingent on government objectives and programs. In this context, ICTs can become implicated in political and economic power dynamics, to the detriment of those who depend on these systems for their social and economic inclusion. Communications technology and digital devices are thus not only agents in their own right but agents active on behalf of the government which can be deployed or withheld, as communications infrastructure and its material artifacts become poignant reminders of state power and of government largesse or neglect. This discussion raises important questions about material agency and its limits that complicate a developmental view of ICT uptake.

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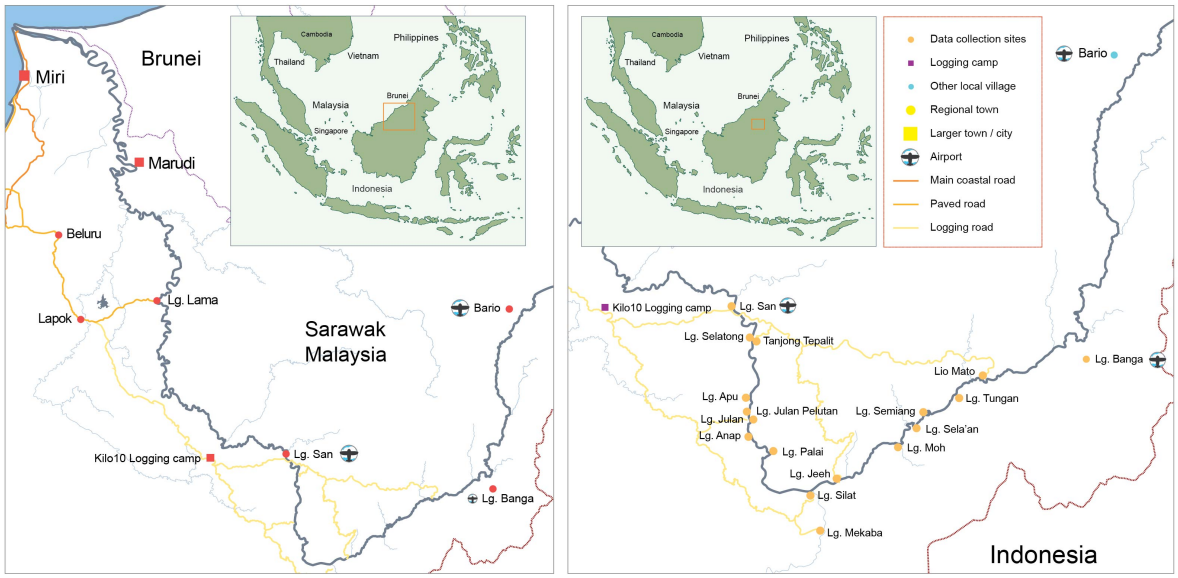
At the same time, however, the process of becoming that results from people's engagements with technologies enable new and diffractive practices and distinct forms such as digital kinds of Indigenous culture and sociality, modes of device use, opportunities for entrepreneurship and methods of leveraging online identities for civic and political participation. As a result of these processes, I argue that technologies emerge not just as government agents but as double agents that facilitate civic and political participation at the same time as they are subject to funding and approval of government institutions.

The paper aims to contribute to a growing field in which the materiality of technologies is front and centre; a materialist informatics (Colman, 2014; Nakamura, 2003), but also a digital materialist (Casemajor, 2015; Reichert & Richterich, 2015) way of thinking about the technologies that have become a crucial part of most people's everyday lives.



Map 1: Fieldwork area

New materialism and the entanglements of the human and nonhuman

New materialism provides a rich theoretical toolbox for studying the relationship between people and technologies. Above all, it suggests a focus away from a human-centric view of agency and towards a more holistic and relational understanding of the world (Coole, 2013; Gamble et al., 2019). Here, technologies are not neutral mechanisms that enable all users to engage in the same practices and achieve the same outcomes (Nakamura, 2003). As Stephens pointed out, "[t]he notion of computer mediated communication figures computers as passive media of transmission, a conceptualization that becomes inadequate when machines are active agents and producers of content" (Stephens, 2014, p. 2030). Digital communications technologies are context-dependent, socially embedded, involved in wider socio-economic, political, technical and environmental processes and bound up in social practices (Adams & Thompson, 2016; Casemajor, 2015; Fuller, 2005). The agentic nature of communications technologies is reflected in a new materialist critique of the established human-centric worldview (Braidotti, 2016a, 2016b), that unsettles the distinction between the human and the non-human as well as the persistent culture and nature binary (D. J. Haraway, 2003), and points to the futility of disentangling the one concept from the other (Latimer & Miele, 2013; Puig de la Bellacasa, 2010; Robinson & Remis, 2014). Increasingly, technologies and bodies exist symbiotically or become indistinguishable from one another; technologies are at times only superficially distinct from the body (Shildrick, 2015), are inscribed on the body (Sullivan, 2012) and become part of the body (Verhoeff & van der Tuin, 2020), prompting a 'somatechnics' (Sullivan, 2012) approach to address the complicated questions that arise when technologies and bodies merge (Bruining, 2013; Pugliese & Stryker, 2009).

Increasingly, new materialist scholars such as Braidotti, Bennet and Barad are invested in exploring the interactions between humans, non-human animals, objects, ideas and processes in ways that are particularly useful for thinking about communications technologies and their agentic potential, not only as a material object produced by and for people but also as agents in their own right. From a posthumanist perspective agency is not exclusive to humans or even living things; instead, "thing-power arises from bodies inorganic as well as organic" (Bennett, 2010, p. 6). Bennett

in particular focuses on the intrinsic vitality of things that becomes evident in their expressive capacity and their ability to exert agency and become actants beyond their significance in human discourse (Bennett, 2010, p. 10); the "efficacy of objects in excess of the human meanings, designs, or purposes they express or serve" (Bennett, 2010, p. 20). This excess can be seen most clearly when the functionality of a device ceases; Bennett brings the example of a bottle cap, a dead rat, but one might also look at a broken cell tower or a mobile phone with a cracked screen or a dead battery. These material objects take on new meanings that may be contrary to those they had held, and while their embodied materiality persists their interactions with other bodies changes; a broken cell tower is overgrown by weeds (see image 3), birds nest in it, it merges with the environment but never quite becomes a part of it.

Another useful way of thinking of the materiality of digital technologies is Karen Barad's concept of entanglement and agential realism (Geerts & Van der Tuin, 2021). Barad uses the term 'intra-actions' to describe ''the mutual constitution of entangled agencies" (Barad, 2007, p. 33) of matter. Through their intra-actions all things are constantly changing and becoming something different than what they were before. Distinct agencies do not pre-exist but emerge through intra-actions and entanglements (Barad, 2007). New materialist concepts such as these are particularly useful for thinking about the effects or outcomes of people's engagements with digital technologies because they point to the dynamic processes by which new ways of being and doing emerge through the use of technologies. Another important concept for Barad is the metaphor of diffraction, a term that refers to the 'interference pattern'' created when a wave meets an object or another wave (Barad, 2007; Haraway, 1992), for thinking about how people and things are affected by each other and by their entanglements and intra-actions. This focuses our attention on subtle changes as people walk different paths, use new words and think differently about themselves and the world in which they live. Different people use communications technologies for different reasons and purposes and achieve different outcomes as a result of their activities (Nakamura, 2003). From a new materialist perspective, these differentiated processes can be seen as "diffractions" (Barad, 2007), as people's entanglements with devices and technologies lead to new ways of becoming, new identities and new material and social engagements. Over time and in aggregate, these processes can

give rise to different kinds of agency where people make use of digital technologies in new ways.

Technologies as double agents

New materialist ideas have much to add to the research of media technologies not only in the context of individual practice but also with regards to entrenched and often implicit societal networks of power through which they operate (Colman, 2014). One of the aims of this paper is to operationalize new materialist theories in a way that draws attention to the potential for empowerment inherent in the use of ICTs but also to question the power dynamics that enable engagements with communications technologies. In particular, I focus on the provision of infrastructure as an example where local people are dependent on state intervention for engaging with the new kinds of agency that technologies seem to promise. I highlight this ambivalence by framing technologies as agents that can be deployed strategically, where entanglements are either facilitated or restricted, and the way this affects the potential for agency. Access to communications technologies is controlled by political and market forces that act as the ultimate gatekeepers to digital access; hence, these are the forces that limit the agentic capacity of digital communications technologies.

And yet, technology's agentic potential cannot be fully controlled; within the parameters set out by the gatekeepers people's entanglements with media technologies create new possibilities and the potential for agency for people in my study to realise the "transformative capacity" (Hickey-Moody & Page, 2015, p. 1) of matter. Processes of intra-action are fluid and open-ended (Coole, 2013), as people use technologies for many reasons; to participate in useful or enjoyable activities, to maintain social relationships, or because the idea corresponds with a specific notion of themselves, to name only a few. The diffractions that result from these processes emerge as new ways of formulating local identities, as new social and economic aspirations and as embodied, spatial and temporal knowledges capable of subverting other, more structured or formalized kinds of knowledge (Kenway & Hickey-Moody, 2011). The question of agency and of who controls digital media is timely and continues to emerge across different global regions in the way that governments

block access to mobile phone coverage in times of crisis or conflict, implement nationwide firewalls, and support or limit online participation in crucial ways. My focus on the distribution of digital infrastructure is thus only one of the many ways of probing the agentic potential of technologies.

I will now explore the area in which the research took place to provide some context to participant's contributions and ideas and discuss my conceptual approach to this work.

Image 1: Long Sobeng in the rain

Image 2: View of Long Selaan longhouse

Background

Fieldwork communities

The fieldwork for this research took place in northern Sarawak, a state of Malaysia on the island of Borneo. The main city in this region is Miri, Sarawak's second most populous city. The area is home to several small and ethnically and linguistically diverse Indigenous groups. My research focused on remote villages in the heavily forested region of the Baram River and its tributaries (see map 1). Most villages were located about four to eight hour's drive from Miri through a network of unpaved logging roads. The region was also accessible by air through two small rural airports, one in Long San and the other in Long Banga. Some of the villages had a small clinic, staffed by medical assistants, and a primary school. Most people in this region have traditionally practised shifting agriculture with rice as the main crop along with fruit and vegetables and cash crops such as rubber (Imang et al., 2008; Lian, 1987). Communal longhouses with a shared verandah for people to work and socialise are typical for this region, although more recently people often prefer individual homes (see image 1). Local ethnic groups each have their distinct language or dialect, traditions and customs (Smith, 2015).

Indigenous ways of knowing and being are often seen as relational and holistic and attentive to material and embodied practices and experiential knowledge (Botha, 2011; Rosiek et al., 2020; Young, 2019). Increasingly these ways of knowing and being also include digital technologies and methods for communication (Carlson, 2013; Srinivasan, 2006). Many Indigenous communities and in particular those who live in remote areas still struggle to engage, however, and often because of a lack of access; during my fieldwork only six out of 20 villages had functional ICT infrastructure, with another five where connectivity was available only intermittently. Even so, most people owned mobile or smartphones to connect whenever they were in a location with access, or used their devices to take pictures, listen to music or play games. This desire to engage and participate was one of the strong themes that emerged during my research, hinting at the purposeful entanglements that result when people engage with new practices, experiences, objects and environments. However, an understanding of the political context of the region is also important to understand

how technologies become agentic in this region in multiple ways. I will provide this context in the next section.

Image 3: Logging road connecting local villages

The region where the fieldwork for this study took place was relatively remote, and most of the villages lacked infrastructure such as electricity, treated water or access to a landline telephone or the Internet. These issues contributed to the relative social and economic isolation of the region. The scarcity of different kinds of infrastructure pointed to the relative neglect of the region by the local and federal government, which was not only due to the low population density and subsequent cost and limited political or economic returns of providing infrastructure but it was also related to the socio-political friction in the region resulting from the decades-long unsustainable and inequitable extraction of resources. In particular, the large-scale timber extraction and plantation agriculture in the region enriched local politicians and companies but not local people, and frequently infringed on local people's traditional rights (E. L. Bennett & Gumal, 2001; Brosius, 1997; Cooke, 1997; Leigh, 1998). Proposals to build a range of hydroelectric dams which would have flooded several communities and their traditional lands, further added to the conflict around Indigenous rights and livelihoods (Sovacool & Bulan, 2011) and led to blockades and protests. This context shapes local engagements with existing communications technologies, in particular because the

region is dependent on government provision of infrastructure including communications technologies.

Most ICT infrastructure in this region was implemented by the Malaysian Communication and Multimedia Commission (MCMC, 2016) under Malaysia's Universal Service Provision (USP) that funds programs and interventions including netbooks for students, village WiFi systems and rural and regional Internet centres (GSMA, 2013). Signage identifying programs as government funded accompanied most infrastructure (see figure 5). Many local people were aware of this dependency on outside intervention for ICT access and the provision of access in some ways became a token of government goodwill or lack thereof. A range of participants suggested how political considerations might have been implicated in the provision of infrastructure, suggesting how technologies had become enmeshed in the political and economic power relationships.

In 2017, the Sarawak state government launched the Sarawak Multimedia Authority to increase the pace of development of digital infrastructure. More recently, the region has been supplied with satellite access via a service called CONNECTmeNOW, where local agents buy bandwidth and local people access satellite WiFi hotspots via prepaid accounts. This new method for digital inclusion promises to expand access for local people in the region, perhaps leading to more equitable provision of ICT access.

Image 3a and b: Small cell tower, Long San, and detail

Methods

The data for this paper derives from a larger project focused on the uptake of Information and Communications Technologies in the region and their role in socio-economic participation (Horn et al, 2018; Horn & Rennie, 2018). Data was collected through in-depth interviews and focus group discussions during extended site visits between 2015 and 2017. The research team consisted of six researchers, three of them from Australia and three from Malaysia and based in the state's capital, Kuching.

Research in remote areas can be immersive and even at times confronting, as researchers spend extended time in the communities they want to get to know, sleeping in local people's homes, sharing their food, participating in communal activities and becoming entangled in affective and embodied relationships. This inherent 'messiness' of qualitative research (Lenette, 2020) emerges as a strength within a new materialist framework, reinforcing the relational nature of the world. As Hickey-Moody has suggested, "[n]ew materialism calls for research inquiry via practice, via materiality – it calls for embodied, affective, relational understandings of the research process" (Hickey-Moody, 2015, p. 169). The relational nature of the research was underpinned through the implementation of community-based participatory methods (Koster et al., 2012; Pontes Ferreira & Gendron, 2011). Local researchers, research assistants and other collaborators were instrumental in shaping the research agenda, in planning the research and the data collection. Participants were selected in consultation with community elders and collaborators from the region as well as through a snowballing methodology, as participants referred friends and relatives and other knowledge holders in the community. Interviewers discussed the project and registered consent before each interview, as well as consent for photographs and video and voice recordings. Interviews were transcribed and, where they were held in Bahasa Malaysia or in one of the Kenyah dialects, translated, and analysed according to a range of thematic codes using NVIVO. The study also included a short quantitative survey (Horn et al, 2018) and an investigation of informal transport systems (Horn et al, 2021).

My own engagement with the region started in 2010 during the work for my doctoral dissertation, for which I visited Long San and several of the villages along the Tinjar river (see map 3). During this time I became aware of the embodied and material

media practices particular to the local media environment; the way that drivers stopped at certain points along the road to turn on their phones and make calls because they knew that mobile phone connection was available from a nearby logging camp; people's preference for phones with dual SIM-slots because some places were only connected via one provider; the way that telecommunications infrastructure was located prominently in the centre of the village rather than hidden away on a rooftop, with its functioning frequently the topic of casual conversation (see image 3a,b and image 4). The subsequent research about the role of ICTs in the socio-economic development of the region, in which I was involved as a postdoctoral researcher, provided the opportunity to discuss these practices extensively with research participants and collaborators. In these conversations technologies took on a life of their own in the way that their arrival was highly anticipated, their functioning and often malfunctioning was frequently opaque, while the end of their lifecycle, often premature due to unfavourable weather and other conditions, left people feeling isolated and excluded. Technologies became agentic in particular ways as local people used their devices to share locally relevant information and knowledge and to document local culture and traditions, for social, political and economic participation but also to take part in mainstream media practices such as taking and sharing photographs, listening to music, watching videos or reading the news (Horn, Philip, and Sabang 2018).

Image 4: improvised phone holders and phone book in the place in the village with best connectivity

While these practices were evocative of the agential nature of digital technologies, it also became evident that other forces co-determined the availability of access and the kinds of technologies present in each village. Traces of this could be seen in abandoned infrastructure or wherever signage indicated that the installation of communications technology had taken place under a Universal Service Provision program such as Kampung Tanpa Wayar (Wireless village, see image 5). All this suggested that the entanglements between people and technologies were complex and involved a range of agents, including local community leaders but also the government in the form of local members of the state assembly and the staff of the Malaysian Communications and Multimedia Commission. Technologies thus emerged as agents of the government where the presence of ICT infrastructure became a stand-in for government benevolence or neglect where infrastructure was absent or had not been maintained. This resulted in positive affect and attitudes where access was available, and negative affect and feelings of marginalisation where it was not. All this pointed to complex questions about the role of ICTs in rural and remote communities beyond the simple presence, or absence, of a digital divide (Nair et al., 2010; Pusso & Ahmad, 2016).

Image 5: USP Village WiFi signage, Long San

Ongoing entanglements with technologies

It is hard to overstate the extent to which some remote communities can be isolated in a seemingly interconnected world. In the fieldwork area for this research many small villages had no mobile phone connection and few other ways of communicating with the outside world. The only way for someone outside a village to contact anyone in a village was to call the local radio station in Miri, Radio Television Malaysia (RTM), to broadcast messages during the daily Kenyah language service. This meant that people in the village needed to stay beside their radio and listen closely to the program so as not to miss a crucial piece of information. Where this was the only way of receiving news from the city, people scheduled their daily activities such as tending to their fields and gardens around this one-hour time slot of the daily program. Broadcasting messages on the radio was not a convenient or practical way of sending messages, as one participant explained:

> [When people want to get hold of someone in the village] they normally contact RTM (Radio Television Malaysia). That's the only way. […] If they are in Miri, they get in touch with RTM, what you call Siaran Kenyah [Kenyah language radio program]. Siaran Kenyah is only one hour per day. If you're lucky enough, you can be on air. You can speak directly from RTM, to the people in kampung [village]. But not only one village can hear it, everybody can hear it. That's one of the disadvantages... [And to get through to RTM is] very difficult. Because so many people want to get in touch. And the time is also very limited, 15 to 20 minutes only. So many people want to send messages, they cannot get [through]. Also, if those people in the village did not turn on the radio, they'll miss the broadcast, or if the radio reception isn't good...

The agentic nature of communications technologies emerged in this narrative in the way that technologies were implicated in people's ability to maintain a sense of social connectedness and inclusion but also affected their daily routines. The radio offered a way of connecting with others, new entanglements, new diffractive outcomes, but these connections were tenuous and easily disrupted since bad weather could limit radio reception in the village or where people could not make it back in time to turn on the radio. Above all, these narratives suggested how the radio timetable came to co-determine people's daily activities and thus their livelihoods. Also implicit in these

narratives was the fact that the national broadcaster, RTM, held the key to people's ability to communicate and thus the capacity to enable these communications or change or limit them. The state thus emerged as an invisible but powerful actor upon which all other agency were contingent.

This enmeshing of lives, practices, embodied experiences around the availability of communications technologies was also apparent where different kinds of communications technologies became available. For example, some participants recalled how the government had installed a video phone facility in their village:

> Previously we have, back in the day, in the 90's [or late] 80's, we have this video call [device]. The government gave it to us. We used that, the video call. Can also connect straight to the phone back then. But when it broke down, we sent it to the office [of the organisation that had installed it], then never to return back again. It was good back then, no payments needed.

The installation of the video phone meant that for the first time people in the village could call out to have individual and private conversations. When the service was not maintained, however, their potential for participation was again diminished.

This conditional kind of agency was a recurrent underlying theme where media technologies empowered local people and contributed to their sense of belonging and social inclusion, but always contingent on external powers which local people could not control. This loss of agency is a key point for my attempt at operationalizing new materialist theories in the context of rural access to communications technologies. The entanglements and intra-actions that occur where people engage with technologies are part of an ongoing and fluid process of becoming in which the outcomes cannot be determined in advance; in Barad's words,

> [a]ccording to agential realism, causality is neither a matter of strict determinism nor one of free will. Intra-actions always entail particular exclusions, and exclusions foreclose the possibility of determinism, providing the condition of an open future. But neither are anything and everything possible at any given moment (Barad, 2007, p. 234-235).

Where intra-actions and new diffractive outcomes are disrupted, as where a new method for communication breaks down, the question of power starts to play a role.

This is where the agency of technologies is contingent, in this case on the government agencies that determine the funding of projects, but also enmeshed in yet other relationships, for instance those between local leaders and their political representatives, the governing party or parties, and so on. My use of the metaphor of the double agent points to those limitations and contingencies because they were evident throughout my fieldwork.

People's experience with public payphones, which had been installed in some villages, followed a similar narrative arc (see image 6a and b). Not all villages had payphones but in those villages where they were installed they quickly became embedded in the sociality of the village, as participants in one focus group explained:

> We used to have two public phones but now they are no longer working. [This was] in the 2000s, maybe 2008 [but] nobody came to repair it. At that time when we still had that service, it was easier for us to contact those in Miri. We can hear it ringing from the longhouse. We would see people line up in the evening to wait for their turn to use the phone. It was like a night picnic, as they would group and smoke together while waiting in line.

This underlines the agentic capacity of media and communications technologies and point to the sensory and embodied engagements that emerged as a result of shared access to the payphones. The narratives, of people smoking local tobacco rolled in dried banana leaves to keep away mosquitoes while waiting in the darkness for their turn, evokes the embodied and affective experience of being in place, the smell of tobacco, the hot and humid darkness, the sounds of the village and the forest surrounding it. These sensory experiences are further evidence of the entanglement between people, technologies, the night, the cicadas, as well as the affective experience of listening to the ringing of the telephone, hearing people talk quietly as they wait in line. They are also suggestive of the diffractions that result from these entanglements, in the way that they enabled new relationships, new conversations and new experiences. These new diffractive practices also became evident in people's use of digital devices such as mobile and smartphones.

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Image 6a and b: Payphones in Long Banga, and detail

Mobile matter

If radio and payphones were important resources that provided people in the region with the ability to communicate, the use of mobile phones and in particular smartphones opened up additional possibilities of being socially and economically included. Mobile devices have seen rapid uptake in the region and in developing countries in general (Avgerou, Hayes, and La Rovere 2016). In Sarawak, cheap devices were readily available and people mostly used prepaid services that allowed them to

charge even small amounts. Even older residents in the fieldwork area, including some with very limited education or no schooling at all, owned and used mobile phones wherever they could access mobile phone services. Most felt that being connected via mobile phone and the Internet were important ways of being included in the social lives of their friends and families, in wider society and even in regional and global affairs, to have access to the news, to apps and services that provided information and entertainment, to post photographs to Facebook and send messages via WhatsApp. As one participant pointed out:

> I think it is very important, because nowadays, [many of the villagers], they have telephones…they need to make some calls and messaging to relatives or family members… My opinion is, all the people in the village need the telephone.

These responses suggested that entanglements with technologies contributed to local identities and self-perception, strengthening people's sense of social inclusion at the same time as they also enabled people to share details about their lives with others outside the village. It pointed to a conceptualisation of new materialist theories of agency where entanglements and diffractions occur as an ongoing process, but one in which people's hopes and aspirations play a meaningful role. As Barad (2007) has pointed out,

> intra-actions iteratively reconfigure what is possible and what is impossible—possibilities do not sit still… The notion of intra-actions reformulates the traditional notions of causality and agency in an ongoing reconfiguring of both the real and the possible (2007, p. 234-235).

The reconfiguration of people's lived realities, both their emotional and embodied experience of living in remote communities and their understanding of themselves as being a part of the world and connected with others changed as a result of their technology use. This emerged in the way that participants foregrounded their need to communicate with friends and families, but many also used their mobile devices for professional or economic purposes. For instance, they used their mobile devices to order supplies from shops in the city or to organise transport by contacting one of the local car-owners who provided transport services as part of the local informal transport strategies (Horn et al, 2021). Some used their mobile devices to market

products, often employing their social networks to sell fish caught in the local river or wild meat from the forest. These practices created new economic opportunities for local people and additional incomes for several of our participants.

However, mobile phone connectivity was neither ubiquitous nor reliable in most villages. It was common to see cars stopped by the roadside on an elevation where mobile phone reception was available from a nearby village or logging camp, their drivers and passengers on their phones making calls or sending messages. If the place where mobile phone access was available outside a village was close by, people often built small huts to shelter from the sun and rain while accessing the Internet or making calls. Often, though, they were located many kilometres away from anywhere, and one of my memories of working in the region is standing on a logging road atop a small hill, with vast views of the surrounding rainforest and the mountains in the distance, with the sun burning down and the dust on the road only just settling, to turn on my mobile phone and see if I had any calls or new emails (see image 7).

Engagements with mobile devices also facilitated new social relationships. Most people charged devices at night, when families ran their generators to light their houses or watch television, but some people who were friendly with the school staff could charge their devices at the school or clinic, which ran generators throughout the day to power the facilities. In some villages without mobile phone access, the school and clinic, which had their own WiFi system, were the only places in the village where a connection with the outside world was possible. Those friendly with the staff at the clinic or the school could ask them to send out messages for them, as one participant, a medical assistant in a rural clinic, explained:

> A lot of [people from the village] come for my help, like messaging....Sometimes they come for my help, so I'll help. Like, to send [messages] to their relatives, so I'll help with my handphone.

As these examples suggest, people's engagements with technologies led to other, more wide-ranging entanglements, with other people, the road, the sun and the rain and the mountains. As was the case for other kinds of technologies like the radio and the payphones, new social practices and new material expressions emerged, new routines in people's lives, and new embodied and affective experiences.

Image 7: Driver stopped by the roadside to make a call

Entangling and becoming

Throughout my fieldwork, communications technologies emerged as agentic in the way they changed social practices, led to new embodied experiences and routines, and affected people's sense of inclusion and belonging. At the same time, the material nature of digital infrastructure, its internal workings and individual life cycles also came to the fore. Digital infrastructure in the form of cell towers with solar panels and satellite dishes, WiFi installations and others featured prominently in the local environment. In villages with mobile phone access the cell tower was often built in a central location in the village to provide maximum coverage (see image 2a and b). As was the case for the payphones, however, outages were frequent and infrastructure was not always maintained. In one village, the tower was meant to draw electricity from a small hydroelectric dam, but this project had never been completed and so electricity to run the system was unavailable throughout the day. The tower only worked in the evening when it was connected to a private generator in the longhouse. In another village, the tower often stopped working during bad weather. In several other villages, the cell towers or village WiFi systems had stopped working at some point due to lightning strike, flooding, and sometimes for no obvious reason, and were never fixed. Participants often tried to notify the responsible agency but either did not

know who to contact or had no response to their requests for maintenance. It was often unclear whether local or federal agencies or the mobile phone providers needed to be notified. Whether these structures were purposely obscured or whether maintenance had simply not been considered in the planning process, these problems contributed to people's sense of helplessness and loss whenever their communications infrastructure failed.

This was exacerbated by people's awareness of their own isolated position, as one participant put it, being located "in the middle of nowhere," with their devices the only link to others outside the village. Many people expressed this in terms of their fear of being unable to access support networks in case someone fell ill or keeping track of the wellbeing of their family members. As one participant pointed out:

> If something happens here, it's difficult for us, say for instance if someone falls sick. If we need to contact the helicopter to come, that's one problem. Or, if I want to contact my son at school, on the coast in Miri…

This led to feelings of isolation and social exclusion and to substantial anxieties for local people. The unreliability of the mobile phone service, the limited distribution of infrastructure and the frequent outages and interruptions pointed to the wider power structures governing the provision of service, and thus to the limits of agency that engagements with digital technologies were able to provide.

In spite of the limited digital access, local engagements with communications media were various and rapidly growing, reflecting local social, professional, economic and cultural aspirations, and including the exchange of information and content for social and cultural reasons as well as the emergence of new socio-economic practices. For example, a number of village homestays ran their own Facebook pages to promote tourism in the area, posting pictures of local attractions and offering tours and accommodation. According to one local homestay owner, the ability to access mobile phone service enabled him to promote his business and arrange transport and supplies:

> Most of the time, every two weeks I have to go down, but now we have telephone here, so it makes it a little bit easier even though it is difficult to get

> through sometimes, but it's just good rather than going down [to the city in order] to make a call to somebody.

Other people used Facebook and other social media and messaging apps to promote local products, to order supplies for small local shops or other businesses. These practices were motivated by personal economic interests but they were also grassroots-driven, self-organised and sustainable, and offered local entrepreneurs new professional opportunities.

Many local people also documented the culture and history of the area through digital media technologies, for example by posting images of local events online and sharing them with others (Horn et al, 2018). This included local music and dances, traditional costumes, details from life in the longhouse or from the agricultural cycle. As one participant explained, local cultural traditions provided a strong sense of identity for local people:

> Our cultural [traditions] like dancing, singing, all this we have to keep it up, like when you get married you have to perform our cultural [rites], how we bless the couple [for example]... That kind of thing we cannot leave, we cannot omit from our culture. That's the best thing, that's how we keep our culture, also our dances, how we play the sape [local string instrument], we have to keep it up.

Access to communications media also facilitated political participation. Popular blogs run by local people provided political and social commentary. People exchanged information via WhatsApp groups, much of it relevant to local issues and concerns, and accessed news, often through social media and personal networks. Digital technologies were also instrumental in the political contestation of traditional rights and for highlighting regional injustices. They helped local people to successfully contest unpopular development projects including the construction of a hydroelectric dam in the area (Sovacool & Bulan, 2012), and enabled grassroots groups to highlight crimes such as the mistreatment and rape of local people through logging workers (Ogilvy, 2018; Pak Bui, 2009).

In this way, entanglements with technologies, and in particular with digital technologies, opened up new possibilities for local people to contest their rights, including their right to belong to contemporary society as well as realise their traditional ethnic identities and to achieve access to the same opportunities as other

people in more urbanized environments. These entanglements were not coincidental or random but purposeful, an active, ongoing process of becoming in which people's affective desire to belong played an important role. I suggest that these are diffractions; evidence of the instances where people and technologies interact and where difference emerges as a result, which may be subtle but nevertheless meaningful and in aggregate has the potential to bring about more wide-ranging changes to people's lives and livelihoods, including greater social, economic, political inclusion.

Coda

As I have argued in this paper, technologies are agentic in the way they shape people's daily lives, their routines and livelihoods, in the diffractions that are the outcome of the entanglements and intra-actions between people, devices, infrastructure and other agents. I have used new materialist discourses to explore the different actors that are involved in this process; as Barad points out, diffraction experiments can reveal much about the nature of matter but also of the diffraction grating, the obstacle or object that causes the diffraction (Barad, 2007, p. 83). My use of new materialist theories to explore the agential capacity of ICTs for people in rural and remote areas highlights the emerging techno life-worlds that are the result of increasing ICT use, but also points to the fragility of these processes and the political and economic obstacles that limit agentic potential and thus the scope of entanglements that can occur. This discussion touches on an important point, namely the question of power and control over technologies. Conceptually, entanglements and intra-actions can be seen as fluid and open-ended, but the question of who has access and under what conditions continued to emerge throughout my fieldwork. This points to a directionality in processes of diffraction, an intentionality that can drive entanglements and, while it may not determine the outcomes, emerges as a determinant that enables some processes but not others.

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Acknowledgements

This project was funded through the Swinburne Melbourne–Sarawak Research Collaboration Scheme involving researchers from Swinburne University of Technology in Kuching, Sarawak (Malaysia), and Melbourne, Victoria (Australia). The Melbourne-based project team included Dr Christine Horn, Associate Professor Ellie Rennie, Professor Sandy Gifford, and Dr Rowan Wilken (who was involved in the early phase of the project). The Sarawak-based project team included Mr Gregory Wee Lik Hoo, Mr Wilson Moses Suai, Ms Raine Melissa Riman, and Mr Simpson Njock Lenjau. I would like to thank research assistants Ms Patricia Nayoi, Ms Aurelia Liu Mei Ying, and Ms Adeline Lenjau. I would also like to acknowledge the contributions of the Ketua Kampung and people in Long San, Long Silat, Long Mekaba, Long Jeeh, Long Moh, Long Sela'an, Long Semiang, Long Tungan, Lio Mato and Long Banga, and other villages we visited. Ethics approval was granted by the Swinburne University Human Research Ethics Committee. Research permit was granted by the Sarawak Chief Minister's office.

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