

“Situational When”: Designing for Time Across Cultures

Jennyfer Lawrence Taylor Alessandro Soro Paul Roe Anita Lee Hong Margot Brereton

Queensland University of Technology (QUT)
2 George St, Brisbane, (QLD) Australia
{jen.taylor, a.soro, p.roe, anita.leehong, m.brereton}@qut.edu.au

ABSTRACT

We propose the concept of “Situational When”, an approach to understanding time in interface design not as a point on a calendar or clock, but as a set of converging circumstances that constitute “the time” for happenings to take place. Time is encoded both explicitly and implicitly in designed products. However, many technologies propagate business-centric, modernist values such as scheduling and efficiency, and marginalize broader socio-cultural aspects on which many activities are nonetheless contingent, e.g. the right people, the right weather conditions, and the right vibe. We derive our reflections from a case study of a cross-cultural digital noticeboard designed with an Australian Aboriginal community. Attention to the situational when opens up new possibilities for design that put greater emphasis on the social and relational aspects of time, the situational insights embodied in local narratives, and the tangible (e.g. people) and intangible (e.g. energy) circumstances that together make up the “right” time.

Author Keywords

Time; Temporality; Calendar; Noticeboard; Storytelling; Cross-cultural; Aboriginal; Breaching Experiments

ACM Classification Keywords

H.5.m. Information interfaces and presentation (e.g., HCI).

INTRODUCTION

We acknowledge the Australian Aboriginal peoples and the Warnindilyakwa people of Groote Eylandt, whose culture and knowledge date back countless generations.

Human-computer interfaces and design processes are inherently culturally situated [37], just as our understandings and experience of time are socially and culturally constructed, comprising physical, social, environmental and cultural aspects [31]. These socio-cultural aspects of time are embedded in designed products both explicitly in temporal interfaces such as calendars, and

implicitly through information organisation, representation, and navigation [62]. Technologies embodying the clock and Western calendar thus have the potential to “implicitly embed” designers’ temporal biases [49], and can influence users’ experiences and practices whose own cultural perspectives of time may differ.

Many ICTs emphasize corporate, “modernist” temporal values such as planning, scheduling, efficiency [9], which can marginalize social aspects of time. The differences between how people perceive time and how time is encoded in technology is exacerbated in cross-cultural design contexts. Prior work in the African context has demonstrated some of these tensions. For example, in Kenya the workplace use of ICTs that privilege “fast-paced email exchanges” with overseas connections over the cultural preference for “co-present communication” perpetuates power imbalances by disrupting local rhythms [84]. We use a case study with an Australian Aboriginal community to explore and reflect on these differences. In particular, time and planning in Australian Aboriginal cultures is rooted in relationships to country and seasonal cycles [10] [23], family and community obligations [39], relationships to “the Dreaming” [78], and a “life-as-contingent” approach to time management [34].

We present a case study of a cross-cultural design project of a Digital Community Noticeboard with an Australian Aboriginal community, using a series of participatory “breaching experiments” [20,27] to highlight issues with the temporalities embedded in technologies, and determining implications for design of the noticeboard. Our study takes up calls within the design community for “deeper reflection” on time and design [9] by examining ways in which the noticeboard interface can reflect the community’s collective time practices. We contribute the theoretical lens of the “situational when” for understanding the ways in which circumstances converge to enable something to happen. This approach accounts for the relationship between the community’s time practices and social protocols, knowledge, and the environment. We outline the ways in which the situational when is culturally-situated, particularly value judgements about “ideal” and “real” situations, and how situations can intersect with linear, cyclical, and multidimensional temporalities. Finally, we describe design implications for the noticeboard and cross-cultural time and design studies.

Permission to make digital or hard copies of all or part of this work for personal or classroom use is granted without fee provided that copies are not made or distributed for profit or commercial advantage and that copies bear this notice and the full citation on the first page. Copyrights for components of this work owned by others than the author(s) must be honored. Abstracting with credit is permitted. To copy otherwise, or republish, to post on servers or to redistribute to lists, requires prior specific permission and/or a fee. Request permissions from Permissions@acm.org.

CHI 2017, May 06 - 11, 2017, Denver, CO, USA

Copyright is held by the owner/author(s). Publication rights licensed to ACM.

ACM 978-1-4503-4655-9/17/05...\$15.00

DOI: <http://dx.doi.org/10.1145/3025453.3025936>

RELATED WORK

Time as Socially Constructed

Time is a fundamental part of the human experience underpinning every aspect of our individual lives and our relationship to the world. Scholars have long acknowledged the complexity arising from studying the experience and perception of time [31]. Historically, the “rationalization of temporal reference” is rooted in the introduction of international communication and transport networks [85]. Yet, the imposition of standardized time zones that differ from daylight hours is not without practical, religious, and political opposition [85]. The social sciences in particular have interrogated the socio-cultural aspects of time. For example, Hall’s “Map of Time” demonstrates the complex relationship between ‘individual’, ‘group’, ‘cultural’ and ‘physical’ time, extending beyond the clock or calendar [31]. Hall’s model encompasses physical and biological phenomena such as the movement of the sun, religious and metaphysical elements of time, units of measurement, and interpersonal experiences and cultural practices [31]. Alternatively, Lewis and Weigert’s typology for social time [44] comprises four layers: “self-time”; “interactional time”; “institutional time” and “cyclic time” [44].

A number of cultural models have been developed to compare different cultural perspectives of time, with many taking business temporalities as a point of departure. These include Hall’s monochronic/polychronic index [31] for comparing modes of work, Levine’s quantitative method for ‘pace of life’ comparison [43], and Brislin and Kim’s ten concepts to understand the effects of culturally specific understandings of time on “intercultural communication” [16]. Examples of these dimensions are “clock and event time”, “punctuality”, delineation of work and social time, “efficiency vs. effectiveness”, “pace of life”, “silences”, and “symbolic meaning of time” [16]. However, taxonomic time models have similar limitations to the taxonomic cultural models such as Hofstede’s cultural dimensions [35] that are used to derive design implications as in [48]. These limitations include defining culture in terms of nation states [36], where models are developed based on “dominant behaviours” [62], and time and culture are seen to be impervious to change [62].

Instead, a practice-based scholarship views time as a “symbolic process continually being produced in everyday practices” [50]. For example, Orlikowski and Yates define time in terms of “temporal rhythms” that are “shared temporal structures [that people] enact recurrently in their everyday practices” [56]. Through these temporal structures “people make sense of, regulate, coordinate, and account for their activities”, with examples including seasons, school timetables, and workdays that are “multiple, heterogeneous, and shifting” [56]. Alternatively, Blount and Janicik’s theoretical model of temporal structures comprises “explicit schedules”, “implicit rhythms” and “organizational cultural norms about time” [11]. These

practices are reflected by temporal artefacts such as calendars used by different cultures to convey agricultural, religious, and civil time practices [22]. Furthermore, sociological work such as Giddens’s structuration theory defines “intersecting planes of temporality” through which social structures and action mutually produce and reproduce each other: “day-to-day” temporality, human lifespans, and social institutions (as in [40]). Lindley advocates for a practice-based definition of time as “collective and entangled”, constituting a “set of relationships” between people [46]. This social rather than individualist perspective of time may resonate with the collective nature of Australian Aboriginal cultures.

Time and Design

Time is an aspect of culture that is “central” to the field of interaction design given the temporal nature of interactions between people and technology [73]. Designers are concerned with understanding the user’s experience of time, and designing these experiences into interfaces such as calendars [17,22,83], timelines [6,7,45], and group collaboration tools [5,18,26] to facilitate time practices. Influential time and design scholarship includes the notion of “slow technology” that advocates for interface design that slows down users to “promote moments of reflection and mental rest” [32]. This is achieved by developing unintuitive interfaces that take users time to learn and understand [32]. Additionally, Lundgren proposes a “toying with time” approach to design by changing a set of proposed temporal themes (e.g. live time, sequential time, etc) in existing interfaces in order to “enhance functionality and/or interaction” [47]. Rattenbury et al.’s work in ubiquitous computing discusses “plastic time” as the “unplanned, opportunistic” gaps in the schedule that many users fill using mobile personal computers [60].

Prior cross-cultural design and time projects are largely centered upon workplace collaboration tools and draw on taxonomic perspectives of culture. For example, Rau et al. compared time management behaviours of Chinese, Japanese and Germans including list making, planning, and calendar use through a survey-based study in order to develop group collaboration tools [61]. Similarly, Chalot addresses the development of a cross-cultural time management app for meeting scheduling for French and Chinese students through a photo diary study [18]. Reneicke et al investigate similar issues with a larger sample size of 1.5 million Doodle polls with users from over 200 countries, comparing factors such as response times and consensus levels between individualist and collectivist cultures [63]. A small number of prior projects, particularly in the African context, illuminate the relationship between the time and culture (e.g. [55]), particularly with respect to technology [9,84].

Time, Design, and Aboriginal Australia

Previous work suggests that different lived experiences of time between Western institutional and Australian

Aboriginal cultures can influence the ability of Aboriginal people to fully benefit from mainstream education, employment, and healthcare services [1,34,39]. This can be observed in the relationship between past, present, and future, where time in Australian Aboriginal cultures is “multidimensional” and the past and present together both constitute “the time” [39]. This perspective can conflict with Western approaches to healthcare, where treating patient histories as “linear” may alienate Aboriginal clients who experience time differently [39]. Aboriginal planning and time management practices can also differ to those in institutional contexts. For example, some Aboriginal cultures take a “life-as-contingent” approach to time management that prioritize “immediate social demands” from family and community [34]. This means that Aboriginal people may miss health appointments or fail to pursue medical treatment if it prevents them from fulfilling their social responsibilities [34].

Prior design projects with Australian Aboriginal communities have been conducted with a particular focus on recording and preserving Indigenous cultural knowledge in ways that are consistent with worldviews of the communities with whom they work. These projects include the Ieramugadu Cultural Information System (ICIS) [75]; Verran et al.’s “TAMI” knowledge management system [77]; Bidwell and colleague’s use of “grounding documentaries” for Indigenous knowledge transfer [10]; George and Nesbitt’s cross-cultural design of an “indigenous website” [29]; and Radoll et al.’s proposal for improved ICT support in Aboriginal Land Councils [58]. Some of these projects contributed to the discussion of time; for example, Bidwell et al.’s study addresses the centrality of place in Aboriginal experience of time, where the landscape is the nexus of past, present, and future voices [10]. Verran et al. discuss the coexistence of “secular here and now” in Aboriginal cultures with the “transcendental eternal time and place” that constitutes creation knowledge and stories known as “the Dreaming” [77]. Seasonal calendar interfaces have been designed with a number of Australian Aboriginal communities in both paper and digital form (e.g [54]) to reflect Aboriginal ecological knowledge.

However, few studies outline approaches for designing for time practices in the cross-cultural design context of Australian Aboriginal communities. Our interest in how time is experienced in Aboriginal cultures stems from designing a Digital Community Noticeboard with an Aboriginal community, and questioning how time might be suitably represented. We have come to know the community through the lens of the Digital Community Noticeboards Project with the Australian Aboriginal people of Groote Eylandt. We describe the Noticeboard project before explaining our method of analysis which uses a series of breaching experiments to examine the relationship between the community’s time practices and technology, and resulting design implications.

PROJECT OVERVIEW

Digital Community Noticeboards Project

Groote Eylandt is a very remote Australian Aboriginal community of 1200 people [59]. Residents comprise of both Warnindilyakwa Aboriginal people who speak both the Anindilyakwa language, and non-Aboriginal people who predominantly work in government organisations or the island’s manganese mines [12]. The schools and many residents own iPads [13] and have appropriated smartphones and cameras for education, communication, and entertainment purposes [68]. Telecommunications infrastructure such as 4G internet is gradually being deployed on island [3], while other barriers to technology use include a lack of literacy and digital skills [68]. Prior ICT projects on Groote Eylandt have include a platform for digital storybook creation [25], a bible translation [41], multimedia on health and welfare topics [38], and a bilingual dictionary application [2].

The Digital Community Noticeboard project is a joint endeavour between an urban university-based interaction design research team and the Groote Eylandt Land Council, originating in 2012 through dialogue with the community [14]. The goal of the project is to develop “public communal technologies harmonised to the Warnindilyakwa” [13] to facilitate information sharing in the community, in particular between government service providers and local residents [14]. The noticeboard system comprises large touch-screens connected to small computers that host the noticeboard software, and emit a local Wi-Fi network to access the content on mobile devices [66,68]. The noticeboard software supports both oral and written traditions by enabling community members to author stories combining text, audio recordings, images, and videos in both English and Anindilyakwa, on topics such as health, welfare, and education.

Designing for Cross-Cultural Perspectives of Time

Prior resources about time on Groote Eylandt include the Anindilyakwa dictionary [30] and a range of prior seasonal calendar projects [30,33,79,81]. We observed cross-cultural differences in the way that people experience time on the island such as the community’s preference for ‘event’ rather than ‘clock’ time for coordinating activities [58]. These differences have presented challenges for designing aspects of the noticeboard interface such as a mechanism to ensure that material depicting deceased people is not displayed at culturally inappropriate times [66]. The aim of the study was to investigate how the noticeboard interface can reflect cross-cultural understandings of time and support local time practices, by bringing together Aboriginal and Western institutional temporalities on the noticeboard. We recognise that time practices cannot be neatly attributed to “Anindilyakwa” and “Western” cultures. Instead, a “generative view” of culture on Groote Eylandt recognises that time practices, as with cultural practices, are “hybrid” and “overlapping” [36,37,49]. For example, the Warnindilyakwa people use both clocks, and traditional

ways of indicating the time of day such as the sun's position in the sky [30]. The Groote Eylandt community actively seeks to “stand in both worlds” [3] by celebrating and enriching their Aboriginal culture whilst also engaging with the Western economic system, and designing for cross-cultural time practices supports this vision.

METHODOLOGY

Statement of Positionality

The Anindilyakwa community has chosen to partner with our research team and university as part of a nationally funded research project to develop communication technologies specific to their needs. Our role in the project involves both undertaking research into new systems and theoretical perspectives, and producing working prototypes. As researchers with a participatory design philosophy, our aim is to include the community as much as possible in the design process and support their appropriations of the technology. Though the community members did not take an active role in authoring this computer science research publication, we acknowledge that the perspectives about time come from the community, and data and publications are guided by dialogue in-line with a rigorous ethics protocol.

Postcolonial, Participatory Design Approach

Before describing our methods, we will first explain the postcolonial context and how this approach applies to our study. The term “postcolonialism” is often used to refer to the contemporary context of people and lands that were previously colonised. Maori scholar Linda Tuhiwai Smith eschews the term postcolonial as she argues that indigenous peoples still live with being colonized [74]. Australian Aboriginal peoples were colonised, removed from their lands and resettled into communities where they now live, largely under Western governance and institutions. Thus, colonialism is strongly felt and lived. Postcolonialism also refers to methods of engagement that seek to engage and empower the community, and thus our methodological approach seeks to give the community voice through co-design activities. While the analytical lens of “breaching experiments” may seem to embody a colonial perspective, it is in essence a recognition of our attempts to understand local Aboriginal culture and our Aboriginal partners' attempts to understand how they might embrace a digital technology into their own lives.

The project engages with a participatory design approach reflecting the view that people should be involved in designing the technology that they use [64]. We recognise that definitions of “participation” are culturally-situated relative to local values of the user community [82], since design is informed by and situated in the “social, embodied and contingent nature of everyday work practices” [64]. Our participatory approach involves working from existing resources produced by community [13] and seed content, much of which was developed with the community. We focus on positive engagement and relationship building

with community members prior to design activities taking place [13]. Our iterative process of design and evaluation is driven by field trips to the island and visits from community members, with a focus on supporting the community to design desirable futures involving technology use, and chart our progress towards them as a project team [71]

Our approach to understanding time and culture is rooted in a “practice paradigm” for design [42]. From this perspective, we examine time as performed through “[...] historical processes and performances, longer-term actions” [42], rather than temporality as individualistic, and “momentary and ahistorical” during an interaction with technology [42]. A practice-based perspective of time is also consistent with a postcolonial, generative view of ‘culture’ as being “dynamic, collectively produced, and enacted in everyday encounters” [37]. We focus on the social aspects of time as “contingent beliefs” and “temporal meanings” that are socially constructed and culturally relative [28] given the collective nature of the noticeboard as a public display interface, rather than individual experiences of the passage of time and memory [44].

Methods

We conducted interviews, design workshops, and utilised the noticeboard as a cross-cultural dialogical probe [67] with a range of different Aboriginal and non-Aboriginal community members. Participants included staff from different levels of government, linguists, rangers, school teachers, and broader community residents. Participants comprise long term project partners who were involved in the grant application, or introduced to us by other residents during our field visits since 2012. The methods used were not mutually exclusive; hands-on “workshop” activities were often part of an interview, or activities designed as a hands-on “workshop” session instead formed the basis for discussion. The activities were recorded through a mixture of handwritten notes, audio recordings, photos, videos, and field diaries according to the participants' preferences. Plans needed to be flexible and were contingent on the presence and availability of community members during field trips on island, two of which focused on the topic of time and the noticeboard. Five key research “instances” formed the basis for this study”, involving approximately ten participants.

Dialogue and Workshops

We conducted some semi-structured interviews with community members who were familiar with the conventions of interview-based research on a range of topics including time management and planning, seasonal cycles, and the desired features for the noticeboard. However, standard interviewing techniques such as asking direct questions can be construed as “intrusive, disrespectful and damaging to relatedness” for Aboriginal people [53], and the benefits for community can be unclear to participants [15]. Therefore, many of our conversations instead took the form of “yarning”, an Indigenous method

involving loosely structured practice of conversation and storytelling [8]. In conjunction with the interviews, we engaged in tangible activities with community members on island as a means of “active exploration, learning and making” [14] about time practices. These activities included photo elicitation to discuss how to display old photos and the knowledge associated with them, and prototyping of different ways to group and order content using both paper and the noticeboard interface.

Cross-Cultural Dialogical Probes

Cross-cultural dialogical probes [67] involve the use of design artefacts as a means for sparking conversations about the broader socio-cultural context. The use of “unmanned” cultural or technology probes in cross-cultural design research may widen gaps in understanding, particularly if they are incompatible with Aboriginal knowledge systems that value “situated knowledge creation, orality and co-presence” [67]. The noticeboard served as a cross-cultural dialogical probe that was used in co-present participatory design activities to foster two-way dialogue and information exchanges about time practices and technology use.

BREACHING EXPERIMENTS AS AN ANALYTICAL FRAMEWORK

Overview of Breaching Experiments

We explored tensions between cross-cultural time practices and the noticeboard through a series of “breaching experiments” [20,27]. Breaching experiments are a sociological construct popularised by Harold Garfinkel in the 1960’s as an approach to explicitly studying the “common knowledge”, “rules”, and “shared understandings” that underpin the everyday activities that shape our world [27]. Breaching experiments make this hidden context “visible” by generating disruptive circumstances that subvert ordinary social protocols [27]. A response to his breach of protocol elicits “disorganized interaction” from participants, thereby illuminating “structures of everyday activities” through the process of challenging them [27]. Garfinkel notes a range of reactions from participants including “confusion” and “bewilderment” through to “shame, guilt and indignation” [27]. Some examples of breaching experiments conducted by Garfinkel’s students included behaving in the household setting as if they were a lodger, and bargaining in a fixed price store [27]. However, breaching experiments are not formal scientific experiments but instead serve as “aids to a sluggish imagination” [27].

Breaching experiments were introduced into human-computer interaction research by Andy Crabtree in 2004, whereby novel technology served as a “breaching experiment” in allowing researchers to stimulate and observe the practices of their use when there were none previously available to study [20]. Crabtree studied the “common stock of knowledge” accessed by players in a collaborative mixed reality mobile game [20], evaluating

user practices by “confronting the technology with real world circumstances of use” [20]. While Crabtree’s study resonated with Garfinkel’s intent of studying “shared understandings” underlying practice as a means of providing intellectual ‘inspiration’, his study did not aim to generate “disruption” and the resulting negative emotions described in Garfinkel’s work [20]. While breaching experiments have been adopted as a method into a growing body of design research including [19,24,52,57,65,69,80], they have not previously been used for cross-cultural design projects, or the study of time and design.

Use of Breaching Experiments as a Cross-Cultural Analytical Framework

Since time is “social” and “collective” [46] and understandings of time are culturally-relative [28], breaching experiments are well positioned to explore the cultural basis of time practices. As with Crabtree’s approach, we engage with the idea of using technology as “breaching experiments” in ways that provoke interesting discussions with the community members rather than generating “disruption” and the negative emotional reactions this may elicit [20]. While the design activities set out to understand what temporal information could be posted to the noticeboard, often the most illuminating discussions about time practices stemmed from dialogue about particular uses of the noticeboard that *wouldn’t fit* with the community’s time practices. While the researchers were not able to directly observe some of the practice under discussion (e.g. funeral coordination), we demonstrate that this lens can still usefully be applied in circumstances where dialogue about practice was the primary data source.

Rather than serving as an explicit aspect of the study design, the concept of breaching experiments was instead applied as a data analysis method since a thematic analysis did not reveal illuminating insights about time practices in this particular community. Garfinkel himself questions the use of data coding as an analytic method for studying practice [21]. This analytic lens was incorporated since it added clarity to the presentation of the empirical findings, and reflected our experience of encountering many potential uses of the noticeboard that were incongruent with the community’s time practices. Moreover, breaching experiments offer a way to reconcile disparate data about time practices gathered through a range of methods including general observations, interviews and dialogues, design activities with the probes, and secondary sources. This supports the integrative work of an interaction design researcher in the research through design process [86].

Yet, our use of breaching experiments in a participatory design project changes the nature of the relationship between the “researcher” and “subject” with respect to their original formulation. In Garfinkel’s original experiments, roles of the “researcher” and “subject” were well-defined; the researcher designed the experiment, and the subject was not aware of their involvement in an “experiment” until it

was revealed to them by the researcher [27]. In Crabtree's experiments, the researchers are the interaction designers who create and evaluate the technology breach, while the subjects are the technology users [20]. However, in participatory design projects, the boundaries between designer and user become blurred as the users become involved in the design activities [64]. Instead, they become a conceptual tool for two-way dialogue and reflection between the research team and participants on the temporal assumptions and biases embedded in technology.

FINDINGS

We present our results and analysis as a series of three breaching experiments that exemplify the relationship between time practices, culture, and technology in three areas: social protocol, information management and the environment. The research team identified breaching experiments based on key events and practices discussed with community members with clear implications for technology usage. While the temporality of sequencing and navigating stories on the noticeboard was also examined through a further set of activities, we restrict the discussion to the practice-based rather than interactional breaching experiments.

Time Practices and Social Protocol

Breaching Experiment #1 Outline: Funeral Organisation

This "breaching experiment" involves time practices around organising a funeral. Funerals are significant events on Groote Eylandt that affect many members of the small island community. The process comprises a range of activities including mortuary and funeral ceremonies, and involves ceremonial song and dance, religious services, and interment. The breaching experiment involved the juxtaposition of using a digital noticeboard to communicate the timing of a funerals that hitherto have always been communicated through word of mouth. It involved discussing with various different community members over several visits, whether the noticeboard could be used for advertising the timing of a funeral to members of the community.

Funerals can result in many absences from school, and the suggestion had been made that communicating the timing of funerals through the noticeboard, giving more certainty to the date of the event, may reduce the amount of time that children were absent from school. The community also has noted the challenges of "balancing cultural obligations with employment demands" [3], including funerals, ceremonial commitments, and family responsibilities. We sought to explore this idea of creating a funeral notice with linguists, school students, and long-term communities, with the data from these experiments triangulating to suggest a common view about the role of the noticeboard in funeral time practices.

Observations about Time Practices

When a community member dies, particular family members of the deceased are designated to bring together

the elements of a funeral where "lots of actors work in concert". The exact timing of a funeral is not scheduled in advance, but instead depends on the "right" factors being in place for a funeral to occur. These factors include:

- *The availability of the "right" songmen.* Funerals involve performing the set of songs associated with a particular person in the right sequence to "sing" the spirit away, and only certain people have the authority to sing these songs.
- *The availability of the Indigenous pastor to perform the religious service,* as the community's worldview is framed by both Aboriginal and non-Aboriginal religious practices.
- *The presence of the deceased's family members,* who may need to travel across the island or interstate.
- *Timing of other funerals in the community,* which cannot happen concurrently according to social protocol.
- *The physical presence of the deceased on island.* There are limited number of morgue places available on island which generates logistical constraints around funeral timings.

Some aspects of funerals are more "scheduled" than others such as organising the church service for the funeral. However, a participant commented that "once a funeral day happens in the community, the pace of it happens when it needs to happen". Sometimes delays to the start time of a funeral or mortuary ceremony can arise from unforeseen circumstances and funerals can involve "a lot of waiting around time". One factor that causes delays is waiting for the "right person to arrive". A participant stated that "You'll think there is a large crowd there, but everyone can be waiting for one person, [...], it can be the person you least expect". In another instance, people did not have access to the right ochre to use as body paint for a mortuary ceremony, which involved going to the aged care centre to retrieve the key to the men's shed after hours in order to fetch the ochre.

The Noticeboard as a "Breaching Experiment"

Considering funeral coordination from the perspective of how a digital noticeboard might provide support challenged fundamental thinking about the noticeboard and brought clarity to understanding funeral coordination practices. Funerals were identified as being unsuitable events to coordinate through a digital noticeboard, being "far too contextual" as the timing of a funeral is contingent rather than fixed. Attempting to specify a time on the noticeboard in advance may operate in tension with social protocol if specifying a time does not allow the "right" elements to come together, nor accord respect to the right people. A funeral notice would need to be constantly updated to reflect changes in circumstances, and the effort of making these changes to the notice may distract from more important organisational tasks. Moreover, it may not be clear who would have the responsibility and authority to create the funeral notice as the planning unfolds through a

process of discussion and negotiation whereby many different people come together. If funerals were to be listed on the noticeboard, it would only be possible after the noticeboard is well appropriated and key community members decided for themselves how it could be used in this way.

Time Practices and Information Management

Breaching Experiment #2 Outline: Sharing and Displaying Multimedia Content

This breaching experiment relates to managing the circulation and display of multimedia content on the digital noticeboard. Multimedia has previously been kept in a wide variety of repositories, most of which are only accessible through personal contact with the maker or holder of the materials. Community social media platforms such as the digital noticeboards may make it easier to display and circulate photos, names, and information about community members. However, this also gives rise to the potential for the noticeboard to display at times that may challenge social protocols.

A particular concern for the community was managing the display of notices with the names or images of deceased people. Users may not be aware that the noticeboard contains material about a deceased person until the moment of encounter with a notice while using the noticeboard. In many Australian Aboriginal cultures, the circulation of photographs and use of first names of people who have passed away is “restricted during a period of mourning” [4]. Determining ways to manage and moderate content to prevent encountering images of deceased people during a mourning period was an important topic of discussion with community Elders during early stages of the noticeboard design [66]. The noticeboard interface already includes a “report” button that allows users to hide content from view until it is reviewed by an administrator.

The insights for this breaching experiment were drawn from two activities. Firstly, there was discussion with the some community members about the use of the noticeboard as a multimedia repository, and with broader community members about general knowledge transmission practices. Secondly, there was dialogue around a collection of old photographs to determine whether and how these photos could be displayed using the noticeboard interface.

Observations about Time Practices

Some participants expressed an interest in using the noticeboard as a centralised repository for storing multimedia content such as photos and videos. The multimedia room houses the noticeboard, and media officers are responsible for creating and moderating new material such as interview videos and transcriptions with local artists. Sharing multimedia artefacts is a key issue for the multimedia officers as community members frequent the community facilities such as the Arts Centre to request copies of pictures and videos that they can view at home. The current system of DVD burning is time consuming and

seen as an increasingly “redundant” process. The imminent deployment of 4G infrastructure also presents new opportunities to network noticeboards in different sites together and share content between them.

The fact that an ‘expiration date’ could be configured for a notice was seen to undermine the utility of the noticeboard as a permanent and reliable multimedia repository. The fact that content is hidden from the noticeboard after its default “expiry” date of two weeks after the notice creation has passed challenged the perceived reliability of the noticeboard for multimedia storage. Contrary to concerns about “stale” content in prior noticeboard literature [72], old content is not perceived to be a problem as people enjoy revisiting old memories. This repositions the noticeboard from a perfunctory information point to a longer-term media storage hub. Additional visions for the interface include the ability to watch longer artist interview videos with multipage transcripts, and transport it to display artist information alongside artworks at exhibitions.

With respect to managing content of deceased people, participants explained that there are cultural sensitivities about displaying their pictures and text until the mourning period has passed. Current communication practices with respect to deceased people including referring to them by clan name rather than first name (e.g. “a [Clan Name] man” or “Mr [Clan Name]. If people encounter a photo of a deceased person displayed in a public place such as the Linguistics Centre, they will tell the facilities manager to “take this photo down”. The wording of the report button’s dialogue box (“you are reporting this page as inappropriate or offensive”) may not be appropriate. A photograph of a deceased person is not considered “offensive” in itself, but it may simply be the wrong time to display this material on the noticeboard. Many of the photos discussed with participants have been taken in the 1950’s through to the 1960’s of people who had since passed away. Participants suggested that it is important to display these images after the mourning period has concluded “so people can remember [them]”.

The Noticeboard as a “Breaching Experiment”

Considering the use of a digital noticeboard to share and display multimedia content that is largely held offline with various owners and custodians challenged thinking about posting and moderation mechanisms. Mechanisms that have been designed for time practices governing “perfunctory information exchange” can operate in tension with community perspectives about the permanence of noticeboard “stories”, where their importance and relevance does not diminish through the passage of time. This breaching experiment indicates a desire for manual, flexible, and transparent control over the storing and sharing of multimedia content.

The use of the noticeboard for displaying photographs of people who are deceased before the mourning period has ended may operate in tension with the community’s social

protocols. However, the noticeboard can also play an important role in keeping the memory of deceased people 'alive' within the community. More nuanced moderation mechanisms have been requested to manage the content of deceased people. However, timing of the mourning period cannot be specified in advance using calendar dates, rather, it is contingent on decisions made by community Elders and family members that it is the "right" time to show this material again, as far away as one year after the funeral has taken place. This breaching experiment further illustrates the implicit nature of time practices and cultural logics that may not be accessible to cultural outsiders, but participation in the design process by "cultural experts" can ensure that interfaces account for these social protocols.

Time Practices and the Environment

Experiment #3 Outline: Communicating Timing of a Recurring Event on the Noticeboard

This breaching experiment relates to communicating the timing of a recurring social community event using the noticeboard. Clocks and the Western calendar assist with the coordination of island life, particularly in the context of work. However, the Anindilyakwa dictionary suggests that time words corresponding to the position of the sun are also used to communicate the time [30]. Seasonal calendars denote names of seasons and periods of time in the Anindilyakwa language that differ from Western calendar months [30,33,79,81]. The data from this breaching experiment is drawn from dialogue with some older community members about how they would design a notice for a regularly occurring community event, such as the weekly women's dancing, and from our photo elicitation activity that took place during the same dialogue session.

Observations About Time Practices

Participants communicate the time of day by using both clock times and the sun position words in Anindilyakwa language, but these serve different purposes. A participant told us that in institutional settings, people use clock time on their mobile phones in order to plan activities and track the start and end times of the work day. This was often the case on our field trips, during which the project team planned design activities according to clock and calendar dates with community members ahead of time. However, there are few public clocks or watches used outside of institutional settings. Participants told us that in Anindilyakwa language they communicate the time of day in terms of sun and shadow positions. Harris elaborates on this in his thesis, asserting that the question used to ask the time in Anindilyakwa language can be translated to mean "how much is the sun?" [33]. Some people point to the past or future position of the sun in the sky to convey a "more specific" time of day [33]. Environment markers are also used to track time over longer periods. For example, Harris remarks that the community relates the time passing "growth and human development" [33]. We observed this first hand during the photo elicitation, where a participants made temporal associations with particular photos by

talking about people (e.g. "when my sister was alive"), or estimated the age of a photo based on the number of buildings and trees in the background. For women's dancing, rather than using clock times, participants stated they would instead use the more approximate sun terms listed in the Anindilyakwa dictionary, though they may not actually include this information on a notice. Elders decide when the dancing will take place either on the day or the day before, and this is conveyed verbally through the community by "passing the message on from family to family". This raises of the question of who would have the authority and responsibility to author such a notice specifying the dancing times.

When asked about making a notice for the dancing, participants stated that they did not want any photos or visual representations of the sun positions on the noticeboard. Instead, they preferred "just messages telling the people where the dancing will take place". The fact that dancing usually takes place in the evening and only involves women in the community is implicit knowledge held by usual participants. These decisions about the communication style for conveying temporal information about the dancing reflects the community's oral cultural traditions in the sharing of community information. Additionally, participants reflected on the way that the time practices of the dancing indicated both cultural continuity and change. According to one participant, the women's dancing used to happen every evening after school, however now it takes place once a week- "it's not happening now, it's different".

The Noticeboard as a Breaching Experiment

Considering the use of a digital noticeboard for communicating the timing of regular community events that is usually shared through word-of-mouth brought to light the ways in which the noticeboard is and isn't needed for this purpose. Prior noticeboard projects have typically afforded explicit communication about the timing of community events and activities. Using the digital community noticeboard on Groote Eylandt in this way could be seen to "breach" time practices around the organisation of the dancing, as the timing of the event may be common knowledge that is not useful to post on the noticeboard, while the venue may change periodically. Additionally, the current interface only allows users to write time terms in English or record them orally, but not capture them visually through icons or through embodied interactions that reflect the practice of pointing at the sky. Social protocols could be breached if someone specifies the timing of the dancing on the noticeboard without the authority to do so. Rather, the noticeboard may be better suited to for conveying the "fixed" elements of an event that need to be arranged in advance, such as transport for a community meeting, or simply to communicate the joys of participation in the women's dancing or candle making.

A SITUATIONAL APPROACH TO TIME

The “Situational When”

Our breaching experiments involving time practices and noticeboard use on Groote Eylandt demonstrate a key tension between scheduled times defined by the clock and calendar, and the “right” situation for an event as defined by community members. Thus, we propose a situated approach to time called the “*situational when*”, that views time not only in terms of the clock or calendar, but as a set of circumstances that converged to enable a past event to happen, and will converge for a future activity. The “situational when” provides a more nuanced mechanism for conveying the situated meaning of “when” something has or should occur than clock or calendar time, privileging the social and relational aspects of time practices. Analysing the circumstances converging to form an event enables a more in-depth understanding of the “material and social circumstances” governing time practices, in line with Suchman’s assertion that “plans” are necessarily a “weak resource” [70]. Situations are socially defined by community members and often given a particular name; for example, “funerals”, “work meetings”, and “social events” were all important to community members as illustrated in the breaching experiments. Situations can comprise a mixture of “fixed” and more “flexible” social circumstances, some that are more suitable for advertising on the noticeboard than others.

An example of the “situational when” is a notice created by the linguists depicting the four stages of shell candle-making, with the directive to “come to the women’s centre to make beautiful candles”. There are photographs to accompany each step in the candle making process, along with spoken recordings in Anindilyakwa language and short written descriptions in English. When asked “when” this notice happened, the notice maker stated the notice happened “a long time” ago as the “right” type of wax is no longer available to make the candles. The “situational when” of the candle making can therefore be better understood by the circumstances that allow the candle making to take place: a particular time of week, the right people being together, in the right place to make candles, with the right wax and shells and knowledge of crafting practices to make candles, and a lack of conflicting social obligations. While the notice’s English text lacks explicit temporal references, many of the circumstantial factors comprising the “right time” for something to happen are implicitly conveyed by the notice content.

The “Situational When” as Culturally Relative

While the “situational when” could be generally applied to understanding the cultural aspects of time practices, the meanings associated with the “right” circumstances for something to happen are culturally-relative. Breaching Experiment #1 shows that a range of circumstances need to come together to make up the “right time” for a funeral, which may be prioritised and ordered different for advertising a funeral in a different cultural context (e.g.

funeral notices in Australian newspapers). A range of “resources” [70] influence time practices on Groote Eylandt such as social protocols in Anindilyakwa culture, or local government processes for securing event logistics such as transport and venues. Yet, these resources may not belong to “one culture” or “another culture” but are shared by community members at the “cultural interface” [51]. In a Western institutional context, an activity may start at a particular date or time on the basis that they have been scheduled for this time, even if situational factors such as the weather are not favourable. On the other hand, in situations when time practices are not dictated by the clock, other situational factors may take priority as evidenced in all three breaching experiments.

The “implicit” and “explicit” knowledge about the circumstances of a situation are socially defined, influencing the way that situations are communicated on the noticeboard. For example, in Breaching Experiment #3 when creating a notice for the women’s dancing, community members emphasized the “where” as being the important information to share on the noticeboard. This suggests that dancing participants already know that it typically occurs in the evening at the same time each week, and displaying this tacit knowledge on the noticeboard would be redundant. Community members expressed the “right” people that need to be at a funeral or particular meeting can be tacit knowledge for community members. In this case, the noticeboard may serve to render this common knowledge visible to others for the benefit of visitors or newcomers who may not have access to this shared understanding.

“Ideal” and “Real” Situations

The “situational when” recognises that there may be differences between the “ideal” situation that constitutes the “right” time for something to happen, and the “real” circumstances that play out when a situation arises. This distinction between the “ideal” and the “real” is inspired by Turner’s ethnographic work on Groote Eylandt kinship structures [76], who asserts that kinship rules are “an ideal model to be emulated in practice” by guiding people’s behaviour “in the direction of the ideal” [76]. The “right time” corresponds to an “ideal” set of circumstances for a situation to happen, respecting the community’s social protocols and traditional law. In Breaching Experiment #2, the “right time” to show images of a deceased person is when the mourning period has passed. In the “real situation” where a photograph may be displayed at the “wrong” time, corrective action may be taken to hide the photo from view through the moderation mechanisms and reactivate it once the “right” period of time has passed. Additionally, as situation unfolds, there may be a discrepancy between the temporal information in the noticeboard content and the timing of a “real” situation. Designers should therefore reflect on whether technology such as the noticeboard interface widens or narrows this gap between the “ideal” and the “real” situation.

The “Situational When” and Multidirectional Perspectives of Time

The concept of “situational when” accounts for “linear”, “cyclical”, and “multidimensional” aspects of time that are practiced in the Groote Eylandt community. This challenges the typical dichotomy of Western time as purely “linear” and Aboriginal time as purely “cyclical”. Some aspects of time in the Groote Eylandt community take a linear form, such as relative timelines from past to future in the dictionary [30]. Participants described the community as being “future focused” where people “handle the future by doing something now” such as educating children about traditional ecological knowledge. “Situational when” also intersects with the “cyclical” aspects of the community’s time practices, such as the “situational when” of “gathering yams” that happens during April or May each year and “when the tall grasses mature and the seeds fall, the ground is dry enough to seek new season’s yams” [33]. Additionally, “multidimensional” aspects of Aboriginal time such as the reincarnation of a person’s spirit into the past, present, or future informs time practices around funerals (Breaching Experiment #1) and managing content of the deceased (Breaching Experiment #2).

DESIGN IMPLICATIONS FOR THE NOTICEBOARD

The breaching experiments illustrate that the role that the noticeboard plays in the community’s time practices depends on the particularities of a situation, the intended purpose and audience of the notice, and the broader contextual factors such as social protocols, communication practices, cultural knowledge, and environmental factors. Particular uses of the noticeboard that may operate in tension with the community’s time practice include those in which the content and use: “breaches” social protocols about information management; does not accurately reflect the “real” timing of a situation; conveys implicit “common knowledge” that is not useful for community members; and widens the gap between “ideal” and “real” situations. Additionally, noticeboards only suit material that is intended to be shared publicly and to endure. Other kinds of communication technologies may suit the community’s time practices that do not preserve an enduring digital record and that allow private as well as public channels.

Instead, uses of the noticeboard that are more suited to the community’s time practices are those that: convey the “fixed” logistical elements of a situation that need to be planned in advance (e.g. the transport arrangements for an excursion on country); enhance a shared sense of history and identity by “remembering” community members and observing the ways in which cultural practices have changed over time; support learning and educational activities by reflecting cultural knowledge encoded in artefacts such as the dictionary; convey the relations between people, culture, place, and objects through time; and support knowledge and communication practices that respect social protocols. Thus, a key design implication is that: *the interface must be flexible enough to reflect the*

different ways in which the time practices of a particular situation unfold.

Interface enhancements that would better enable the noticeboard to reflect cross-cultural perspectives of time in terms of content creation include: mechanisms to express sun time and relative time terms; a drag-and-drop “situation builder” for more efficient ways of constructing and communicating situations; and better consideration for tools such as maps that would enable users to locate stories in place. Interface enhancements for accessing content on the noticeboard that support situational time practices include: nuanced moderation mechanisms; linking “old” and “new” content together in ways that explicitly reflect cultural continuity and change; and time-related learning games relating to seasonal activities for educational purposes.

CONCLUSIONS

This paper has provided theoretical and empirical contributions to designing for cross-cultural temporalities, grounded in the case study of a Digital Noticeboard design project with an Australian Aboriginal community. We have taken a social, relational, and practice-based perspective of time, and have outlined participatory design methods for explicitly addressing these cross-cultural perspectives of time. Our “breaching experiments” have illustrated that time practices in the community are deeply rooted in the relationship between time and social protocols, knowledge, and the environment. Through cases such as funeral coordination, we have demonstrated tensions between time practices and technology such as a scheduled versus a contingent approach to planning and coordination, though the boundaries between the two are blurred.

Given the marginal role played by the calendar and clock in time practices and community life on island, we advance the “situational when” to approach timing as a set of circumstances that come together to form “the time” for something to happen, with particular consideration of the “right” and “wrong” times. We recognize that the “right time” for some activities can depend on a “confluence of circumstances” that may not be appropriate to express through the noticeboard. However, other temporally bound content such as an upcoming visit by health practitioners is important to convey in written and oral forms in both languages on the noticeboard to ensure that community members do not miss out on these opportunities. Since technology is enabling Aboriginal communities to actively design a future for themselves where they can “stand in both worlds” [3], it is important for communal interfaces to be designed with care and flexibility in order to support these visions of the future to be realized.

ACKNOWLEDGEMENTS

We thank and acknowledge the Anindilyakwa community and their Land Council for the opportunity to develop this noticeboard with them, as well as the Australian Research Council for Linkage Grant (LP120200329). Thank you to the reviewers for their constructive feedback.

REFERENCES

1. Kelly Adams. 2009. *The Perseverance of Aboriginal Australian Time Philosophy and its Impact on Integration Into the Mainstream Labor Force*. School for International Training, Washington, DC.
2. ALNF. 2016. First Language Literacy. *ALNF Website*. Retrieved May 18, 2016 from <https://alnf.org/program/first-language-literacy/>
3. Anindiyakwa Land Council. 2012. *ALC 15 year Strategic Plan (2012-2027)*. Anindiyakwa Land Council, Alyangula, Groote Eylandt.
4. Australian Government. 2009. Cultural protocols relating to deaths in Indigenous communities. *Indigenous Portal*. Retrieved November 2, 2016 from https://apps.indigenous.gov.au/cultural_protocol.htm
5. James Begole, John C. Tang, Randall B. Smith, and Nicole Yankelovich. 2002. Work Rhythms: Analyzing Visualizations of Awareness Histories of Distributed Groups James. In *Proceedings of the 2002 ACM Conference on Computer Supported Cooperative Work (CHI '02)*, 334–343. <http://doi.org/10.1145/587078.587125>
6. Peter Bennett, Mike Fraser, and Madeline Balaam. 2012. ChronoTape : Tangible Timelines For Family History. In *Proceedings of the Sixth International Conference on Tangible, Embedded and Embodied Interaction (TEI '12)*, 49–56. <http://doi.org/10.1145/2148131.2148144>
7. Arnaud Berenger and Mountaz Hascoet. 2013. Toward an Abstract Relative Timeline. In *CHI 2013 Workshop: Avec le Temps! Time, Tempo, and Turns in Human-Computer Interaction*. <http://doi.org/10.13140/2.1.2397.8882>
8. Dawn Bessarab and Bridget Ng'andu. 2010. Yarning About Yarning as a Legitimate Method in Indigenous Research. *International Journal of Critical Indigenous Studies* 3, 1: 37–50.
9. Nicola J Bidwell, Thomas Reitmaier, Carlos Rey-Moreno, Zukile Roro, Masbulele Jay Siya, and Bongive Dlutu. 2013. Timely Relations in Rural Africa. In *Proceedings of the 12th International Conference on Social Implications of Computers in Developing Countries (IFIP Conferences)*, 92–106.
10. Nicola J Bidwell, Peta-Marie Standley, Tommy George, and Vicus Steffensen. 2008. The Landscape's Apprentice : Lessons for Place-Centred Design from Grounding Documentary. In *Proceedings of the 7th ACM Conference on Designing Interactive Systems (DIS '08)* (DIS '08), 88–98. <http://doi.org/10.1145/1394445.1394455>
11. Sally Blount and Gregory A Janicik. 2001. When Plans Change : Examining How People Evaluate Timing Changes in Work Organizations. *The Academy of Management Review* 26, 4: 566–585.
12. Inga Brasche. 2008. Cultural resilience and social wellbeing: A case for research on Groote Eylandt. *Australian Aboriginal Studies*, 2: 93–98.
13. Margot Brereton, Paul Roe, Thomas Amagula, Serena Bara, Judy Larara, and Anita Lee Hong. 2013. Growing Existing Aboriginal Designs to Guide a Cross-Cultural Design Project. In *Proceedings of the 14th IFIP TC13 International Conference on Human-Computer Interaction 2013 (INTERACT '13)*, 323–330. http://doi.org/10.1007/978-3-642-40483-2_22
14. Margot Brereton, Paul Roe, and Anita Lee Hong. 2012. Evolving a relationship for cross-cultural participatory innovation. In *Proceedings of Participatory Innovation Conference 2012*, 1–5.
15. Margot Brereton, Paul Roe, Ronald Schroeter, and Anita Lee Hong. 2014. Beyond Ethnography : Engagement and Reciprocity as Foundations for Design Research Out Here. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems (CHI '14)*, 1183–1186. <http://doi.org/10.1145/2556288.2557374>
16. Richard W Brislin and Eugene S Kim. 2003. Cultural Diversity in People's Understanding and Uses of Time. *Applied Psychology: An International Review* 52, 3: 363–382.
17. Daniel Buzzo and Nicolo Merendino. 2015. Not all Days are Equal: Investigating the Meaning in the Digital Calendar. In *Proceedings of the 33rd Annual ACM Conference Extended Abstracts on Human Factors in Computing Systems (CHI '15)*, 489–501. <http://doi.org/10.1145/2702613.2732512>
18. Heloise Chalot, Cheih Cheng, Chinwen Yu, Pei-Luen Patrick Rau, and Qin Gao. 2016. Time Management Application: Insights on French and Chinese Collaboration. In *Proceedings of the 19th ACM Conference on Computer Supported Cooperative Work and Social Computing Companion (CSCW '16)*, 241–244. <http://doi.org/10.1145/2818052.2869085>
19. Karen Church, Joachim Neumann, Mauro Cherubini, and Nuria Oliver. 2010. SocialSearchBrowser: a novel mobile search and information discovery tool. In *Proceedings of the 15th International Conference on Intelligent User Interfaces (IUI '10)*, 101–110. <http://doi.org/10.1145/1719970.1719985>
20. Andy Crabtree. 2004. Design in the absence of practice: breaching experiments. In *Proceedings of the 5th Conference on Designing Interactive Systems: Processes, Practices, Methods, and Techniques (DIS '04)*, 59–68. <http://doi.org/10.1145/1013115.1013125>
21. Andy Crabtree, David M Nichols, Jon O Brien, Mark Rouncefield, and Michael B Twidale. 2000. Ethnomethodologically Informed Ethnography and Information System Design. *Journal of the*

- American Society for Information Science* 51, 7: 666–682.
22. M Davenport. 2007. Calendar as Culture: An Interdisciplinary Project with an Indigenous Community. *Journal of Cultural Research in Art Education* 25: 79–90.
 23. M. Donaldson. 1996. The end of time? Aboriginal temporality and the British invasion of Australia. *Time & Society* 5, 2: 187–207. <http://doi.org/10.1177/0961463X96005002004>
 24. Brian Due. 2015. Challenges with Google Glass in Social Interaction. In *Participatory Innovation Conference 2015 (PIN-C '15)*.
 25. East Arnhem Shire Council. 2012. ISTORIES. *East Arnhem Shire Council Website*. Retrieved May 18, 2016 from <http://www.eastarnhem.nt.gov.au/istories/>
 26. Danyel Fisher and Paul Dourish. 2004. Social and temporal structures in everyday collaboration. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems (CHI '04)*, 551–558. <http://doi.org/10.1145/985692.985762>
 27. Harold Garfinkel. 1964. Studies of the Routine Grounds of Everyday Activities. *Social Problems* 11, 3: 225–250.
 28. Alfred Gell. 1992. *The Anthropology of Time*. Berg Publishers Limited, Oxford.
 29. Reece George, Keith Nesbitt, Patricia Gillard, and Michael Donovan. 2010. Identifying Cultural Design Requirements for an Australian Indigenous Website. In *Proceedings of the Eleventh Australasian Conference on User Interface (AUIC '10)*, 89–97.
 30. Groote Eylandt Linguistics. 2010. *Eningerribirra-langwa jurra*. Groote Eylandt Linguistics, Groote Eylandt.
 31. Edward Hall. 1989. *The Dance of Life: The Other Dimension of Time*. Anchor Books, New York.
 32. Lars Hallna and Johan Redstro. 2001. Slow Technology – Designing for Reflection. *Personal and Ubiquitous Computing* 5: 201–212.
 33. John Harris. 1979. Ethnoscience and Its Relevance for Education in Traditional Aboriginal Communities. *Masters thesis, Department of Education, University of Queensland, Brisbane*.
 34. Daniela Heil and Gaynor Macdonald. 2008. “Tomorrow comes when tomorrow comes”; Managing Aboriginal Health within an Ontology of Life-as-Contingent. *Oceania* 78, 3: 299–320. <http://doi.org/10.1002/j.1834-4461.2008.tb00043.x>
 35. Geert Hofstede. 1997. *Cultures and Organizations: Software of the Mind*. McGraw-Hill USA, New York City, New York.
 36. Lc Irani and Paul Dourish. 2009. Postcolonial interculturality. In *Proceedings of the 2009 International Workshop on Intercultural Collaboration (IWIC '09)*, 249–252. <http://doi.org/10.1145/1499224.1499268>
 37. Lilly Irani, Janet Vertesi, Paul Dourish, Kavita Philip, and Rebecca Grinter. 2010. Postcolonial computing: a lens on design and development. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems (CHI '10)*, 1311–1320. <http://doi.org/10.1145/1753326.1753522>
 38. Italklibrary. Anindilyakwa. Retrieved May 18, 2016 from <http://italklibrary.com/italk/indigenous/anindilyakwa/>
 39. Aleksandar Janca and Clothilde Bullen. 2003. The Aboriginal concept of time and its mental health implications. *Australasian Psychiatry* 11, Supplement: S40–S44. <http://doi.org/10.1046/j.1038-5282.2003.02009.x>
 40. Matthew Jones and Helena Karsten. 2008. Giddens’s Structuration Theory and Information Systems Research. *MIS Quarterly* 32, 1: 127–157.
 41. Joshua Project. 2016. Language: Anindilyakwa. Retrieved May 18, 2016 from <http://joshuaproject.net/languages/aoi>
 42. Kari Kuutti and Lj Bannon. 2014. The Turn to Practice in HCI: Towards a Research Agenda. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems (CHI '14)*, 3543–3552. <http://doi.org/10.1145/2556288.2557111>
 43. Robert V Levine and A Norenzayan. 1999. The Pace of Life in 31 Countries. *Journal of Cross-Cultural Psychology* 30, 2: 178–205.
 44. J. David Lewis and Andrew Weigert. 1981. The Structures and Meanings of Social Time. *Social Forces* 60, 2: 432–462.
 45. Siân Lindley. 2013. Mind the Gap : The Timeline as a Narrative Frame for Personal Content. In *Proceedings of the Avec le Temps! Time, Tempo, and Turns in Human-Computer Interaction Workshop (CHI '13)*, 5–8.
 46. Siân E Lindley. 2015. Making Time. In *Proceedings of the 18th ACM Conference on Computer Supported Cooperative Work & Social Computing (CSCW '15)*, 1442–1452. <http://doi.org/10.1145/2675133.2675157>
 47. Sus Lundgren. 2013. Toying with Time : Considering Temporal Themes in Interactive Artifacts. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems (CHI '13)*, 1639–1648. <http://doi.org/10.1145/2470654.2466217>
 48. Aaron Marcus and Emilie Gould. 2000. Cultural Dimensions and Global Web UI Design: What? So What? Now What? *White Paper: Cultural Dimensions and Global Web UI Design*: 1–27. <http://doi.org/10.1145/1900520.1900525>
 49. Samantha Merritt and Shaowen Bardzell. 2011. Postcolonial language and culture theory for HCI4D. In *CHI '11 Extended Abstracts on Human*

- Factors in Computing Systems (CHI EA '11)*, 1675–1680.
<http://doi.org/10.1145/1979742.1979827>
50. Nancy D Munn. 1992. The Cultural Anthropology of Time : A Critical Essay. *Annual Review of Anthropology* 21: 93–123.
 51. Martin Nakata. 2007. The cultural interface. *The Australian Journal of Indigenous Education* 36: 7–14.
 52. Carman Neustaedter, Gina Venolia, Jason Procyk, and Dan Hawkins. 2016. To Beam or Not to Beam: A Study of Remote Telepresence Attendance at an Academic Conference. In *Proceedings of the 19th ACM Conference on Computer-Supported Cooperative Work & Social Computing (CSCW '16)*, 417–430.
<http://doi.org/10.1145/2818048.2819922>
 53. Crighton Dale Nichols. 2015. Discovering design: Enhancing the Capability to Design at the Cultural Interface Between First Australian and Western Design Paradigms. *PhD thesis, Faculty of Architecture, Design and Planning, University of Sydney, Sydney*. [http://doi.org/10.1016/0142-694X\(91\)90027-T](http://doi.org/10.1016/0142-694X(91)90027-T)
 54. M H O'Connor and S M Prober. 2010. *A calendar of Ngadju seasonal knowledge*. Ngadju Aboriginal Corporation (NAC) and CSIRO, Floreat, Western Australia.
 55. Damian Ugwutikiri Opatu. 2001. *Towards a genealogy of African time*. AP Express Publishers, Nigeria.
 56. Wanda J Orlikowski and Joanne Yates. 2002. It's About Time: Temporal Structuring in Organizations It's About Time: Temporal Structuring in Organizations. *Organization Science* 13, 6: 684–700.
 57. Erika Poole. 2012. Interacting With Infrastructure : A Case for Breaching Experiments in Home Technology Research. In *Proceedings of the ACM 2012 conference on Computer Supported Cooperative Work (CSCW '12)*, 759–768.
<http://doi.org/10.1145/2145204.2145319>
 58. Peter Radoll, Sebastian Fleissner, Duncan Stevenson, and Henry Gardner. 2013. Improving ICT Support for Aboriginal Land Councils in New South Wales. In *Proceedings of the Sixth International Conference on Information and Communications Technologies and Development: Notes - Volume 2 (ICTD '13)*, 116–119.
<http://doi.org/10.1145/2517899.2517916>
 59. RAHC. 2009. *Community Profile - Groote Eylandt*. Remote Area Health Corps, Darwin, Northern Territory.
 60. Tye Rattenbury, Dawn Nafus, and Ken Anderson. 2008. Plastic: A Metaphor for Integrated Technologies. In *Proceedings of the 10th international conference on Ubiquitous computing (UbiComp '08)*, 232–241.
<http://doi.org/10.1145/1409635.1409667>
 61. Pei-luen Patrick Rau, J Lui, S Verhasselt, T Kato, and C Schlick. 2011. Different Time Management Behaviors of Germans , Chinese and Japanese. In *Proceedings of the ACM 2011 conference on Computer supported cooperative work (CSCW '11)*, 701–704. <http://doi.org/10.1145/1958824.1958949>
 62. Pei-Luen Patrick Rau, Tom Plocher, and Yee-Yin Choong. 2012. *Cross-Cultural Design for IT Products and Services*. CRC Press, Boca Raton.
 63. Katharina Reinecke, Minh Khoa Nguyen, Abraham Bernstein, N Michael, and Krzysztof Z Gajos. 2013. Doodle Around the World : Online Scheduling Behavior Reflects Cultural Differences in Time Perception and Group Decision-Making. In *Proceedings of the 2013 conference on Computer supported cooperative work (CSCW '13)*, 45–54.
<http://doi.org/10.1145/2441776.2441784>
 64. T Robertson and J Simonsen. 2012. Participatory Design: An Introduction. In *Routledge International Handbook of Participatory Design*, J Simonsen and T Robertson (eds.). Taylor & Francis, Florence, 1–18.
 65. Tobias Schwartz, Gunnar Stevens, Leonardo Ramirez, and Volker Wulf. 2013. Uncovering Practices of Making Energy Consumption Accountable: A Phenomenological Inquiry. *ACM Trans. Comput.-Hum. Interact.* 20, 2: 12:1–12:30.
<http://doi.org/10.1145/2463579.2463583>
 66. Alessandro Soro, Margot Brereton, Anita Lee Hong, and Paul Roe. 2015. Bi-Cultural Content Publication on a Digital Noticeboard: A Design and Cultural Differences Case Study. In *Proceedings of the Annual Meeting of the Australian Special Interest Group for Computer Human Interaction (OzCHI '15)*, 217–221.
<http://doi.org/10.1145/2838739.2838813>
 67. Alessandro Soro, Margot Brereton, Jennyfer Lawrence Taylor, Anita Lee Hong, and Paul Roe. 2016. Cross-Cultural Dialogical Probes. In *Proceedings of the First African Conference on Human Computer Interaction (AfriCHI'16)*.
<http://doi.org/10.1145/2998581.2998591>
 68. Alessandro Soro, Anita Lee Hong, Grace Shaw, Paul Roe, and Margot Brereton. 2015. A Noticeboard in “Both Worlds” Unsurprising Interfaces Supporting Easy Bi-Cultural Content Publication. In *Proceedings of the 33rd Annual ACM Conference Extended Abstracts on Human Factors in Computing Systems (CHI EA '15)*, 2181–2186.
<http://doi.org/10.1145/2702613.2732713>
 69. Dagny Stuedahl and Sarah Lowe. 2014. Re-considering participation in social media designs. In *In Proceedings of the 13th Participatory Design Conference: Short Papers, Industry Cases,*

- Workshop Descriptions, Doctoral Consortium papers, and Keynote abstracts - Volume 2 (PDC '14)*, 107–110.
<http://doi.org/10.1145/2662155.2662184>
70. Lucy Suchman. 1987. *Plans and situated actions: The problem of human-machine communication*. Cambridge University Press, Cambridge.
 71. Jennyfer Lawrence Taylor, Alessandro Soro, Margot Brereton, Ani Lee Hong, and Paul Roe. 2016. Designing Evaluation Beyond Evaluating Design : Measuring Success in Cross- - Cultural Projects. In *Proceedings of the 28th Australian Conference on Computer-Human Interaction (OzCHI '16)*.
<http://doi.org/10.1145/3010915.3010965>
 72. Nick Taylor and Keith Cheverst. 2008. Exploring the Use of Non-Digital Situated Displays in a Rural Community. In *OZCHI 2008 Workshop on Public and Situated Displays to Support Communities*.
 73. John C Thomas, Y Pan, T Erickson, E Blevis, C Letondal, and A Tabard. 2013. Avec le temps ! Time , Tempo , and Turns in Human-Computer Interaction. In *Extended Abstracts on Human Factors in Computing Systems (CHI EA '13)*, 3303–3306.
 74. Linda Tuhiwai Smith. 2012. *Decolonizing Methodologies*. Zed Books, London.
 75. Andrew Turk and Kathryn Trees. 1999. Appropriate Computer-Mediated Communication : An Australian Indigenous Information System Case Study. *AI & Soc* 13: 377–388.
 76. David Turner. 1973. Cosmology is “ Kinship ”: The Aboriginal Transcendence of Material Determination. *Mankind* 19, 3: 215–226.
 77. Helen Verran and Michael Christie. 2007. Using / Designing Digital Technologies of Representation in Aboriginal Australian Knowledge Practices. *Human Technology* 3, May: 214–227.
 78. Helen Verran and Michael Christie. 2014. Postcolonial Databasing? Subverting Old Appropriations , Developing New Associations. In *Subversion, Conversion, Development: Cross-Cultural Knowledge Exchange and the Politics of Design*, James Leach and Lee Wilson (eds.). MIT Press, Massachusetts.
 79. J A Waddy. 1988. *Classification of plants and animals from a Groote Eylandt aboriginal point of view*. Australian National University North Australia Research Unit, Darwin.
 80. Astrid Weiss, Regina Bernhaupt, Manfred Tscheligi, Dirk Wollherr, Kolja Kühnlenz, and Martin Buss. 2008. A methodological variation for acceptance evaluation of human-robot interaction in public places. *Proceedings of the 17th IEEE International Symposium on Robot and Human Interactive Communication, RO-MAN*: 713–718.
<http://doi.org/10.1109/ROMAN.2008.4600751>
 81. Christine White. 2005. *Women of the Groote Eylandt archipelago: hunting In the third millennium*. University of New England, Armidale.
 82. Heike Winschiers-Theophilus, Shilumbe Chivuno-Kuria, Gereon Koch Kapuire, Nicola J. Bidwell, and Edwin Blake. 2010. Being Participated - A Community Approach. In *Proceedings of the 11th Biennial Participatory Design Conference (PDC '10)*, 1–10.
<http://doi.org/10.1145/1900441.1900443>
 83. Dezhi Wu. 2010. Understanding Time and its Relationship to Individual Time Management. In *Information Resources Management: Concepts, Methodologies, Tools and Applications*. IGI Global, Hershey, Pennsylvania, 1–11.
<http://doi.org/10.4018/978-1-60566-776-8.ch001>
 84. Susan P Wyche, Thomas N Smyth, Marshini Chetty, Paul M Aoki, and Rebecca E Grinter. 2010. Deliberate interactions: characterizing technology use in Nairobi, Kenya. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems (CHI '10)*, 2593–2602.
<http://doi.org/10.1145/1753326.1753719>
 85. Eviatar Zerubavel. 1982. The Standardization of Time : A Sociohistorical Perspective. *American Journal of Sociology* 88, 1: 1–23.
 86. John Zimmerman, Jodi Forlizzi, and Shelley Evenson. 2007. Research through design as a method for interaction design research in HCI. In *Proceedings of CHI 2007 (CHI '07)*, 493–502.
<http://doi.org/10.1145/1240624.1240704>