A Relational Approach to Designing Social Technologies that Foster Use of the Kuku Yalanji Language

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ABSTRACT

Australia has a rich array of Aboriginal and Torres Strait Islander languages, but they face decline along with many valued aspects of culture unless they are passed down to, and used by, younger generations. Prior work on designing technologies for language learning has often taken particular language skills, learning theories, and technologies as their starting point. Our empirical work with a remote Aboriginal community illustrates four ways in which this community's language practices intersect with family relations and are deeply enmeshed with family histories and stories, Indigenous Knowledges, and activities on and about country. Thus, we argue for a relational approach that instead takes family communication and social activities as the basis for designing technologies that foster everyday language use. We outline the guiding principles of this design orientation, and illustrate how they have been taken up in the co-design of a talking soft toy called the 'Crocodile Language Friend.' Finally, we identify opportunities and open issues in taking a relational approach to designing technologies for language communities with similar needs and aspirations.

CCS CONCEPTS

• **Human-centered computing~Empirical studies in HCI** • Human-centered computing~Field studies

KEYWORDS

Language teaching and learning, intergenerational language transmission, language use, Indigenous languages, Aboriginal and Torres Strait Islander languages, social technologies, family communication, co-design.

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1 Introduction

We acknowledge the Kuku Yalanji, Kuku Nyungul and Jalunji peoples who are the traditional owners and custodians of the Wujal Wujal area.

2019 is the UNESCO International Year of Indigenous Languages, seeking to "[…] promote and protect Indigenous languages and improve the lives of those who speak them" [1]. Indigenous languages worldwide are becoming endangered at an alarming rate, with a 2016 UN Forum predicting that 40% of the world's total languages may disappear unless rapid action is taken [1]. While a rich array of more than 250 Aboriginal and Torres Strait Islander languages existed prior to European contact, 120 languages are actively used today [2]. The benefits of Aboriginal and Torres Strait Islander languages for their speakers include strengthening a sense of cultural identity [3], health and

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wellbeing [2,4], and child development and educational outcomes [5], with social, economic, and environmental benefits for the broader Australian society [6]. The Second National Indigenous Languages Survey concluded that the "active use and transmission of languages is the key to strengthening or maintaining traditional languages" [2]. The survey highlights the importance of the home and family setting for growing language use, supported by language revitalization scholarship [2].

Technology has long been identified as an important tool for supporting language teaching, including the documentation, maintenance, and revitalization of endangered languages [7]. HCI efforts to design for language learning have focussed on aspects such as particular skills (e.g. vocabulary learning [8,9], or reading [10,11]), teaching approaches (e.g. task-based learning [12], collaborative learning experiences [13,14]), and emerging technologies (e.g. Internet of Things [15], augmented reality [8], mixed reality [16] and, gesture-based systems [17,18]). Past work on intergenerational communication (e.g. [19–26]) has also brought to light its emotional dimensions [19,27] and experiential qualities, including fostering social engagement around family routines [24] and a sense of closeness [25,28] over a distance, as well as identifying challenges and barriers [20,23]. Yet, this work has largely not considered Aboriginal and Torres Strait Islander language transmission and use, though some projects with Aboriginal and Torres Strait Islander communities [29–33] incorporate language elements such as cross-cultural communication platforms (e.g. [34]).

We contribute a relational approach to designing technologies for Aboriginal and Torres Strait Islander languages that takes family communication and activities as the basis for technology design. This approach is grounded in empirical work conducted in partnership with the Aboriginal community of Wujal Wujal to co-design social technologies to support Kuku Yalanji language learning and use. In this type of language situation, there are Elders who are fluent language speakers but there are challenges in engaging young children in language activities. We present the findings from interviews and with adult language speakers about their language practices and technology use, that represent four key intersections between family relations and language learning. This work demonstrates the nature of language learning and use as deeply enmeshed with family histories and stories, Indigenous Knowledges, and activities on and about country. We propose characteristics of, and design considerations for, relational language technologies (RLTs), and illustrate how these are reflected in the design of the 'Crocodile Language Friend'. We conclude by identifying opportunities and open issues for designing relational technologies that reflect language community members' needs, interests, and aspirations for the future.

2 Related Work

2.1 Aboriginal and Torres Strait Islander Language Context

Aboriginal and Torres Strait Islanders are the Indigenous peoples of Australia and currently represent around 3.3% of the Australian population [35]. Australia is home to more than 250 different Aboriginal and Torres Strait Islander languages that were spoken prior to European contact, and approximately 120 are still in use today [2]. To coincide with the UNESCO International Year of Indigenous Languages, the Australian Government developed an Action Plan [6] that argues for the importance of preserving, maintaining, and celebrating Aboriginal and Torres Strait Islander languages as they "[…] enrich Australia's cultural life, make a valuable contribution to our national economy and are seen as a cultural asset internationally" [6]. Aboriginal and Torres Strait Islander languages represent a range of language situations; some languages are considered "stable" where they are spoken by people of all generations, some are losing speakers, and some are growing speaker numbers through revitalization activities [2].

However, the National Survey concluded that "regardless of their situation all traditional languages are at risk of declining" [2]. Disruptions to intergenerational language transmission are a key proponent of Aboriginal and Torres Strait Islander language shift and loss [36]. Intergenerational transmission of language is "the process involved in […] passing [a] language down to the next generation, either through informal learning or formal teaching, or a combination of both" [37]. A range of factors influence intergenerational language transmission including parental attitudes [38,39], government policy [37–39], parents skills in the language [38,39], use of the language at home [38,40], access to language resources [38], and the role of the language in formal schooling [41]. Additional considerations in the Aboriginal and Torres Strait Islander language context include the emergence of hybrid and creole languages [2,36], and government policies promoting English literacy in the schooling system [42,43], though Aboriginal and Torres Strait Islander languages are now an explicit focus of the new Australian curriculum [44]. Historical and ongoing forces of assimilation, missionisation and colonisation have impacted on Aboriginal and Torres Strait Islander language transmission, including the ongoing legacy of the "stolen generation" [45]. In some cases, the transmission of Aboriginal and Torres Strait Islander languages in families is associated with ongoing intergenerational trauma, and interventions in this context need to be approached with care and sensitivity. The ongoing vitality of Aboriginal and Torres Strait Islander languages in spite of these forces is a testament to the strength and resilience of their speakers [46].

Aboriginal and Torres Strait Islander communities are undertaking a range of activities for language maintenance and revitalization, and technology has been identified as playing a key role in supporting these efforts [6]. Technology is enriching Aboriginal and Torres Strait Islander language activities in a number of areas. One of these areas is language documentation and recording, such as the Aikuma app for creating oral language recordings and annotations [47], the Living Archive of Australian Languages repository [48], and the Miromaa language and knowledge management platform [41]. There are tangible and digital designs for language teaching and learning, such as the

Opie robot which allows communities to create their own digital games and stories in language [49], the Anindilyakwa Flashcard app [7], and the Western Arranta skin names [26] and plant name games [28]. For computer-mediated communication (CMC) in Aboriginal and Torres Strait Islander languages, platforms designed for this purpose include the cross-cultural Digital Community Noticeboard system [34], with these projects taking a community rather than a family lens. Many existing applications developed for Aboriginal and Torres Strait Islander languages such as mobile dictionary apps are valuable reference materials, yet further work is needed to understand what role they can play in fostering everyday language use in language activities of children and their families.

2.2 HCI Design for Language Learning

HCI design for language learning has targeted different aspects of the language learning process. This has included learning vocabulary in a new language [8], sometimes in preparation for an immersive experience such as travel [9], translating from one language to another [12], and reading texts such as social media content [10] and comic books [11] in another language. While there are a range of commercial technologies dedicated to foreign language learning, some HCI designers are instead approaching language learning as social and situated. The intent of these designs is to create experiences that immerse users in the socio-cultural world of the language speakers rather than teaching grammar and vocabulary out of context [12,14,18]. This is achieved for example through a virtual reality game that situates learners in a Japanese teahouse [18], or augmented kitchen utensils that support people to develop French speaking skills while collaboratively cooking a French recipe [12]. These design interventions focus on social rather than individualistic learning experiences both in-situ (e.g. [12,13]) and over a distance (e.g. [8]). Collaborative learning through devices such as the TandemTable enable both language learning, and the chance to "learn about each other's culture and personal life, which in turn facilitates intercultural learning" [13]. Byamugisha and colleagues specifically targeted language transmission and the role of family game play for informal teaching and learning of Ugandan languages [50], yet few of these HCI projects have focussed on Aboriginal and Torres Strait Islander languages. Additionally, evaluations of many language learning systems focus on measuring language gains rather than social aspects of the language learning experience.

Designing for minority and endangered languages, including many Indigenous languages, presents its own opportunities and challenges. HCI work in this area has spanned a range of languages and geographical locations (e.g. [51–55]), including Australian Aboriginal languages (e.g. [56]). These projects convey the double-edged sword that new technologies present to endangered and minority languages. On the one hand, technology can enable communication between speakers over a distance [57], the dissemination of language materials, wider recognition of endangered languages [55], monetization of language resources by speaker communities [54], and language revitalization activities. On the other hand, new technologies including social media can present "technological and social pressures" for minority language speakers such as negative user experiences with generic interfaces, and difficulties in producing new web content for languages that are not widely represented online [53]. Aboriginal and Torres Strait Islander languages and Knowledges are closely entwined and their performance can be deeply situated in place [58] and encompass sensory and embodied aspects [59]. Design interventions in this space need to account for a language community's specific socio-historical context, social, financial, practical, and technical opportunities, and constraints [7].

2.3 HCI Design for Family Communication

A number of projects have considered technology design to support intergenerational communication (e.g. [19–24], particularly between grandparents and grandchildren, and adult children and their elderly parents. This work has addressed both synchronous [26] and asynchronous communication [26], especially through video technology and online collaborative games and storytelling activities [20]. This work emphasizes the importance of doing shared activities together to stimulate and sustain intergenerational communication [20,26] particularly when children relate better to play than conversation [26]. These activities can include augmenting existing routines to create new possibilities for social interactions, such as Brereton and colleagues Messaging Kettle that supports direct and ambient communication around the ritual of boiling the kettle and making tea [24]. Intergenerational communication has experiential qualities with emotional dimensions [19,27] such as fostering a sense of social engagement and presence [25], closeness [28], and togetherness [25] over a distance. While challenges to intergenerational communication include cognitive [20,25] and social barriers [23], recent work by Munoz and colleagues advocates for fostering empathy through designing in ways that help family members understand each other's positions and differences [60]. We suggest that this emphasis on the qualities of family relations and doing shared activities in shaping family communication practices can yield important insights for designing to support intergenerational language transmission and use. To address these gaps and opportunities, we introduce a participatory design project to create social technologies to support language learning and use by young children.

3 Community, Language, and Project Context

This empirical work was carried out as part of the 'Let's Use Our Language Together' Social Technology Project for Kuku Yalanji, conducted by researchers from Queensland University of Technology in partnership with the remote Aboriginal community of Wujal Wujal. Wujal Wujal is located in Far North Queensland, with a population of more than 650 people [61]. The township is nestled within a rainforest with large waterfalls and a river running through it, surrounded by beaches and coral reefs. The traditional owners and custodians of the land since time immemorial are the Kuku Nyungul, Kuku Yalanji, and Jalunji

peoples [62]. There are various sources of information about the community and its history, such as the Council website [62] and accounts from Government websites (e.g. [63]).

The community has access to a range of services and facilities including an Art's Centre, Indigenous Knowledge Centre, health centre, and community media. In the vicinity there are also primary schools, supermarkets, and tourist accommodation [62]. The community is pursuing innovative projects with emerging technologies such as Internet of Things, augmented and virtual reality, and novel communications infrastructure, some of which have garnered national awards [64], and offer technology classes for youth and older adults in their Indigenous Knowledge Centre (IKC). The community proudly speaks their language, Kuku Yalanji and its dialects, and acknowledges the past and ongoing work of different people and organisations such as the Elders, schools, Justice Group, IKC, and visiting linguists to design and record language materials such as dictionaries, grammars, hymn books, and children's picture books. However, there is a lack of digital technologies to support the intergenerational transmission and use of Kuku Yalanji, particularly for young children. This is a pressing issue as many fluent speakers of the language are Elders, with challenges in engaging young children with learning and using Kuku Yalanji.

The Council invited researchers from Queensland University of Technology to partner with the community on a co-design project to develop social technologies to support young children to learn and use Kuku Yalanji. A Memorandum of Understanding and ethics protocols were put in place. A Reference Group of approximately 12 Elders representing men and women from all three dialect groups was established to oversee and guide the project, including articulating the community's language needs and aspirations, and co-creating and correcting digital content in language. The project was named the "'Let's Use Our Language Together' Social Technology Project for Kuku Yalanji" - *Ngana wubulku junkurr-jiku balkaway-ka*. Four pillars underpinning the project that emerged through dialogue with the Reference Group are: 1) Reuse and build on existing language resources; 2) Use language in social activities with technology; 3) Grow use of the language through social connections; and 4) Target language use at all ages but start by focusing on young children.

4 Methodology

The work presented here has been developed through the first author's PhD project. The aims of this project are to 1) understand existing community language practices and activities and how they are experienced across the different generations; 2) co-design social technologies that focus on language use and are appealing and engaging for young children (aged 3-5); and 3) establish methods for community engagement and design for long term sustainability of the system. The project has taken an iterative, participatory design approach [65,66], with reciprocity and respect serving as core values underpinning the collaboration [67]. The first author, a non-Indigenous computer science student, spent several months of 2018 living in community to take part in project meetings, conduct design activities, and participate in community life such as fishing, damper making, and language lessons.

This paper presents the findings of semi-structured interviews with five adults, some of whom are Elders in the community, about their language practices and technology use. The participants (P1-P5) are, in no particular order:

- an adult who has been involved in language activities with children across different age groups.

- an adult who has been involved in community language activities over a number of years.

-an adult who teaches the language to their young children.

-an adult from a different community residing in Wujal Wujal who has learnt the language and is involved in community language activities.

-an adult who has been involved with activities to teach language and cultural knowledge on country.

The interviews were in English, ran for 30-60 minutes, and took place in private homes, council offices, or community spaces. Participants were asked about how they learnt Kuku Yalanji themselves and now teach it to their children, how they engage with existing language materials, and their use of Kuku Yalanji online. The interviews were audio recorded and transcribed. The primary author conducted an initial thematic analysis [68] of the transcripts. The codes generated reflected the importance of family relations and the home context strongly emerged as something that crosscut most of the interview themes. The data was then re-reviewed through the lens of family relations, guided by the question of what role family relations played in language teaching, learning, and use. This analysis was also guided by a cumulative understanding of context [69] that emerged through Reference Group meetings, co-design workshops, and observations of community activities. Four key intersections emerged between language and family relations. These were then discussed with the Council and Reference Group. We have not yet been able to talk to youth to gain their direct perspective but this is planned for upcoming work.

5 Findings

5.1 Language Use ABOUT Family Relations

The first intersection between language and family relations is language use ABOUT family relations. The topic of family often serves as a starting point for teaching Kuku Yalanji both at home and in educational settings. Talking about family connects to the new Australian Curriculum for Aboriginal and Torres Strait Islander languages [70]. Social life, including the family tree and kinship terms, was one of the language teaching topics for which a previous Reference Group created lesson plans and materials (other topics were animals, directions, land and sea, and body parts). P2 commented that these resources are still used in

children's language lessons today, with family members being a topic that is applicable to every learner. According to P2, the family forms a resource for supporting multimodal language teaching by visualizing the family tree, written family terms, and the sounds of these words: *"[…] you know you got Mum in English and then ngamu, and the kids are seeing the word, how to spell it, and how to say it."* (P2). Starting from the family, children can learn associated language such as how to introduce family members in terms of their life history, personality, and interests.

The relationship between understanding language and cultural knowledge about family relations was also linked to the idea of strengthening "respect" between older and young people and maintaining a sense of identity. According to P2, this existing respect is strengthened through awareness of the family tree "*And that's where […] respect is coming for each other and the community. If you know your family tree, your relations, the respect will come back more."* (P2). P5 stated that respect was also associated with the idea of "*never losing respect for our old people and what they have to offer"* (P5) as custodians of the language. Participants expressed concern about the potential for this respect to be eroded through the process of intergenerational language shift: *"When I'm put six-foot underground, what's going to happen? Are you going to lose the culture, or are you going to lose your language and that respect?"* (P1). This suggests that knowing language about family relations has social benefits in strengthening the intergenerational bonds connecting older and younger language speakers.

It is important to note that Western conceptualization of the 'nuclear family' can differ from Aboriginal kinship systems, which "reflect a complex and dynamic system that is not captured by existing non-Indigenous definitions of family" [4]. This includes views as to who is considered to be a family member, and the network of people involved in childrearing which can be "fluid in their composition, with kinship networks overlapping, and adults and children often moving between households" [4]. Specific cultural knowledge about kinship structures and family dynamics is expressed through the Kuku Yalanji kinship terms (e.g. there are distinct words for 'mother's father' and 'father's father'). These kinship terms in Kuku Yalanji were part of P3's own language learning journey […]*"when we're out hunting and gathering and stuff like that, a lot of the things we were looking for were always, said in the language name, so that made it very easy for us as we spoke. As we grew older we knew different names of animals, different names for uncles and aunties and cousins you know, and all those common things that we speak of. So yeah, that's how I learnt how to speak my local language." (P3).* This reminds us that there is not necessarily a direct mapping between English terms for family relations terms and those in Aboriginal and Torres Strait Islander languages but instead a complex interplay between languages and knowledge systems.

5.2 Language Use THROUGH Family Relations

The second intersection between language and family relations is language use with family members, which is embedded in relationships between particular people and shaped by their qualities. For example, some participants recounted learning by sitting on their grandparent's knee: "*[…] I learnt the language from my grandparents. […] When I used to go home from school in the afternoon and my grandparents used to sit and speak to us in language and say, this is what, you need to speak your language and keep it alive." (P2).* Some adults also used humour as a way of engaging with children. For P5, it was their older family member who *"laughed a lot"* and created songs about whatever activity they were doing which helped them to remember language: *"[…] it was just those little constant tunes that stuck in your memory" (P5).* P2 deliberately brought humour into their language activities to help children who are shy about speaking language feel more at ease and encourage them to *"give it a go"* (P2). Elders expressed a strong sense of gratitude to their older family members for taking on that teaching role, with one participant describing it as *"[…] an honour to learn a lot from my grandmother's side."* (P5). These examples highlight the personal touch in language learning, and suggest the need for playful designs in order to appeal to young learners.

Just as these strong intergenerational bonds can seek to facilitate language transmission, mismatching attitudes can also serve as a barrier. For example, participants emphasized the importance of listening to and respecting Elders and making sure to take up opportunities to be involved in language activities: *"But we have been listening and if I wasn't listening you know, I wouldn't be here telling my grandchildren and my daughter and my son to catch that moment while your parents are telling you" (P1).* However, Elders were concerned that young people are not listening and are taking language for granted: "[…] *our children think that it is going to be around forever" (P2).* Elders were also considering the consequences of these mismatches for generations further down the track, as expressed in the following: *"[…] they will miss out, if they not learn it they're going to miss out on the language, and further down the track when they're having, when they have their little family, you know, and they won't be able to pass it down to their children" (P2).* These examples highlight the nature of language transmission and use as a relational problem beyond the mechanics of the language such as spelling and grammar.

Part of building this empathy and understanding comes from Elders sharing their life stories and family histories and teaching language through this process, with both the language and stories functioning as *"[…] a legacy of the old people"* (P1). For example, one Elder tells their children stories *"[…] of my childhood growing up, and how we learnt different ways, and stories that were told to me by my Grandfather and my Mum and my Aunty"* (P5). Life in community today is different from Elders' own experiences of growing up there. P1 also related stories of how they used to gather food as children and feels that young people may not have shared these experiences "[…] *I think it's hard for them to understand what we went through a long time ago*". (P1). This suggests the potential for social technology designs to assist with learning about and understanding each other's perspectives.

Given the importance of spending time with family members for language learning, participants identified the need to support

language teaching and learning with both adult and child family members who are living away. P4 explained the effects on language learning when children are away from their grandparents: *"[…] those children who live with their grandparents are more fluent than those ones that don't" (P4).* Participants identified several different types of family relations that could benefit from technology to support family communication and language learning over a distance. These include: youth at boarding school; people who are in hospital elsewhere; people who were displaced from community as children and are reconnecting with language and culture for the first time; and families that have moved away from community for other reasons. This suggests the potential to couple language learning with family communication both within the same home, between the home and other community settings, and with people from the community who are living elsewhere.

5.3 Language Use While DOING Family Activities

The third intersection between language and family is the process of teaching and learning language *in context* while doing family activities, particularly when these happen 'on country'. Most interview participants (P1,P2,P3,P5) described language teaching and learning as tightly coupled with social activities on country such as hunting, gathering oysters, fishing, digging for yams, and talking around the camp fire. Participants described their family members *"[…] taking the kids on walks and showing them firsthand the different plants, animals, the area itself, different significant sites" (P2).* Older family members would use questions and answers as a way of eliciting responses in language about what children are doing and seeing on country: *"[…] you say what's this or what's that, or for going this way, which way do we go? Or you know, I'll ask a question in language and [the children] could answer" (P5).* P3 also recounted teaching their own children the language by pointing out things while out on country: *"Whenever we're out and about, you know, if we see different animals, I call them by, you know, the language name. […] that helps them understand what I'm saying, you know, that helps them speak the language*" (P3). This illustrates the situated and experiential nature of language learning through the community's language practices, as opposed to mobile apps where learning is taught independently from user contexts.

There are a number of perceived barriers to teaching language on country. Due to environmental changes, a significant population of crocodiles have moved into the area, making it more difficult for families to do language activities at the river or beach as stated by P1 in the following: *"I like to see them come with us old ladies, and we can show them what we was doing like a long time ago with our parents and going out, but we can't go down the beach, ocean, lot of crocodiles"* (P1) Participants noted that changes in lifestyle such as the establishment of shops in the town and private property has shaped food gathering and preparation activities through which language teaching and learning happens. Elders acknowledged that children's lives are different now as they are immersed in modern technology and there is a need to fit language in with this in ways that are relevant to them. For some, technology holds promise in terms of facilitating and enriching language activities: *"[…] And you can look at creative ideas, what's out there and what's available, and using modern technology, I think it will help move along, and maintain, and encourage that language to be strong" (P3).* Yet, Elders also expressed concerns about taking technology out on country and the need for kids to *"leave phones at home" (P5)* when doing activities outdoors with Elders. This begs the question of whether and how to take technology on country, but also how technologies for language learning can bring country into the home.

Participants (P1-P5) discussed a number of different types of family activities that facilitate language teaching and learning. Firstly, singing and songwriting in language, including adults singing songs to their children, a community choir that performs Christmas carols in Kuku Yalanji, and a rap song in language created as a collaboration between the school and an NGO. Secondly, dance and movement for expressing language such as ceremony and corroborees e.g. *"I take them [children] to [festival] every year, every activity that we do here with the language and that, when we had the corroborees here and stuff like that"* (P3). P2 discussed the idea that dance also enables people to pass language onto others when they see their peers telling stories through dance and replicating them. Thirdly, religious practices, such as people saying nightly prayers in Kuku Yalanji or using a Bible translated into language as a reference for the written form. Fourthly, storytelling orally or with the use of printed storybooks, with P4 characterising language learning as a "*story-based process"* (P4). Finally, P5 described the role of art and artwork for teaching language *"[…] use artwork, use cultural activities, put language name against [them]" (P3),* with the value of these activities being the ways that they can bring older and younger generations together socially, i.e. *"[…] have the local Elders to go down here to go down and work with the kids, create that environment where you can have that interaction" (P3).*

5.4 Focusing Design on Family Language Use and Working Outwards FROM the Home

The fourth intersection between language and family relations is the idea of focusing on family language use as a starting point for design, and working from the home outwards to other contexts where language is used. As previously mentioned, the Reference Group decided that the language project should start by focusing particularly on young children at the preschool age, and that the type of language reflected in technology designs should be short and grammatically simple. Existing programs run at the IKC such as First Five Forever focus on adults and children singing songs in language together. However, less resources are available to assist older family members to teach children language at home, but technology offers an avenue for supporting family language activities as it is something that children are surrounded by and interested in. This can be seen in the following quote from P2 "[…] *we can use technology now, because of all our younger people these days, because they so much into technology now and so, [we can] use the technology as a tool to teach our children." (P2)*

Participants emphasized the need to start with language in the home where young children start acquiring language, echoed by the Reference Group. P3 felt that the family setting and family relations in the home is a productive focal point for language technology as "[…] *home is very important, that's where I learnt a lot of my speaking, to learn the language is very important" (P3).* One reason for this is that parents and other older family members can engage in developing 'family language policy' [71] by setting parameters as to how language is taught and used at home. This was reflected in P1's comment *"[…] talk kuku, you know, when you go to high school you can speak English, but when you home, ngana talk kuku. […] don't forget about our language". (P1)* Participants expressed the idea of starting by learning language from the self and family relations and then building outwards to other community language activities. For P4, this was about learning from the body outwards: *"So they start off using one or two words, Yalanji language words, by the end of it, they're speaking whole sentences, they're having whole conversations, they're troubleshooting in language, you know? And we were always taught back home, like, you learn a language from the body out (P4).* For P3, this was also reflected in the idea of starting within the family and then engaging with the language of other dialect groups. "*I try and get them [children] to interact with their grandmother, she's very good at speaking language. A lot of my relatives, they speak language as well, so I try and create that interaction, with those different family groups (P3).*

6 A Relational Approach to Designing Technologies for Indigenous Languages and 'Relational Language Technologies'

Based on this empirical work, we propose a relational approach for designing technologies with language communities where older speakers are still alive but engaging youth in language learning and use can be challenging. These four intersections between language and family relations suggest that the process of teaching and learning for Aboriginal and Torres Strait Islander languages such as Kuku Yalanji is deeply enmeshed in both particular relationships between family members of different generations, and the broader backdrop of the community's collective culture and kinship network. Learning and understanding Kuku Yalanji is not only about learning vocabulary and grammar, or oral and written literacy skills, but it is also about knowing family history and stories, understanding country and people's relationship to the land, and spending time doing things together for language immersion.

Thus, we propose a *relational approach to designing technologies to support language teaching, learning, and use* that takes family communication and activities as the starting point for design. This orientation can help us design in ways that engage older and younger speakers together in language activities, and enrich these relationships by fostering dialogue and understanding. Additionally, we suggest that leveraging existing family routines and interactions in playful ways can help to grow everyday *language use* to complement and expand on language documentation and preservation activities. While this approach may not be applicable to every language community, we hope that other communities who relate to this language situation may find this approach useful even if not every principle applies in their context. We refer to technologies developed through this relational approach as *Relational Language Technologies (RLTs).* Tangible and digital *social technologies* that "enable and seek out participation and contributions by users" [72] are well-positioned to take up this orientation by entering into a language community's 'network of relations' [73] through which language activities and practices emerge. The form and content of social technologies are shaped by their use and can thus be personalised to reflect the needs and interests of particular families and family members. They can facilitate communication within families through and around the technology, and as "containers or scaffolds" [72] they can reflect the diverse ways in which language is actively used within a family. We discuss aspects of this relational approach in the context of social technology designs.

6.1 Guiding Principles for a Relational Approach to Designing for Language

We propose the following guiding principles for a relational approach to designing languages teaching, learning, and use:

6.1.1 Principle 1: Designing for family relations with, around, and through technology for language learning: In seminal Computer-Assisted Language Learning (CALL) work, Egbert and Petrie propose a definition of CALL as "learners learning language in any context with, through, and around computer technologies" [74]. Adapting this perspective to designing RLTs suggests that these interactions could include family members: 1) interacting directly with the technology together in language, 2) interacting with each other in language around the technology, where the designs could prompt co-located discussions or activities such as inventing or playing games with the technology; and 3) interacting in language through the technology, such as family members leaving each other messages that are played when the technology is taken to different places.

We anticipate that RLTs could be used in the home and social settings in which interactions between the child and device may be overheard by others in the room such as parents or grandparents. This could initially invite legitimate peripheral participation in the Lave and Wengerian sense [75] from older family members, with mutual engagement with the language and the technology growing over time and through use. Social technologies could also support both active learning through direct interactions, as well as language immersion by ambiently playing a recording at random at regular intervals as with the Ambient Birdhouse [76]. This could solicit incidental use and serve as a playful reminder that the local language speakers are present and the language is alive today.

6.1.2 Principle 2: Facilitating community-generated content creation around family relations: The intent of RLTs is to provide a platform for users themselves, such as the members of a particular family, to create their own language recordings. On one end of the

spectrum, RLT interfaces could be more open to support unstructured communication (e.g. common CMCs and social networking sites) but incorporate language tools. On the other end of the spectrum, interactions with social technologies could consist of structured language lessons where community can still preload their own language materials but the format is more tightly prescribed, or somewhere between the two.

6.1.3 Principle 3: Personalising designs for particular children and family members: By virtue of soliciting user-generated content, RLTs that embody a relational design approach can allow families to personalise the designs and customise the content. This can allow them to target specific learning needs of family members (e.g. an emphasis on certain language areas such as memorizing vocabulary, pronunciation skills, or learning words, sentences, and questions about a particular topic), reflect family stories and knowledge, and capture user interests and aspirations.

6.1.4 Principle 4: Supporting family relations where everyone is a language teacher and learner: RLTs could challenge fixed roles of Elders as teachers and children as students. Participants expressed the fact that everyone regardless of their age is at a different stage of their learning journey, and even Elders who were fluent speakers have an interest in building on their reading and writing skills. Thus, RLTs can support and scaffold learning at different levels where the language content could evolve as the child grows and family members around the child can be part of the learning journey.

6.1.5 Principle 5: Fostering intergenerational engagement with language through playful and humorous interactions: Since humour was identified as useful for sparking and maintaining children's engagement with language activities, RLTs could appeal to different generations within a set of family relations through playful and humorous interactions. This can also help to make recording and using the language feel less intimidating for people who are less confident with speaking the language.

6.1.6 Principle 6: Bridging language activities conducted through family relations with broader community language goals and activities: RLTs that people can easily take with them to different places such as phone apps or talking soft toys means that the social technologies could travel and bridge between diverse sets of relations in contexts such as the home, kindergarten, school, workplace, youth group activities etc., mediating between different literacy ideologies and practices [77].

6.1.7 Principle 7: Connecting technology design with language teaching contexts such as learning on country: RLTs could support language activities on country but also address barriers to access by seeking to bring country into the family home through audio recordings of nature, and words and stories about aspects of country such as plants, animals, seasons, and hunting practices.

6.2 A Relational Language Technology: 'The Crocodile Language Friend'

6.2.1 Co-Design of the Crocodile Language Friend Design

We have worked with the community over a period of two years to co-design a talking soft toy crocodile called the 'Crocodile Language Friend' to assist young children (particularly in the 3-6 years age range) to actively learn and use Kuku Yalanji. The Crocodile Language Friend (Figure 1) is a soft toy that is embedded with a Raspberry Pi and a speaker, microphone, LED strip, RFID reader and tag, battery, and buttons in the feet that allow users to change between the different modes. For these early stages of the prototype we have used an off-the-shelf soft toy, with the view to work with the community to create their own toys in future. There is no screen on the Crocodile Language Friend so interactions are based around audio and voice interactions, to tie in with oral language traditions, and emphasize social interactions and embodied play over screen-based interactions. The crocodile runs a web application that users can connect to with their own devices using a private WiFi network. The app allows users to create pairs of language recordings in English and Kuku Yalanji comprising single words, sentences, or longer stories, with both languages played back on the crocodile, and users can set different combinations of recordings to play by enabling or disabling them.

The current functionality of the software has four interaction modes: 1) a greeting mode when it is first turned on with a customised greeting message using the child's name; 2) a playback mode in which users can press a button to play a language recording on the crocodile at random; and 3) a repeat mode, in which the crocodile asks users to record themselves repeating one of the language recordings and immediately plays their own voice followed by the original recording; and 4) An Ambient Mode in which the crocodile plays a recording at 15 minute intervals when it is not being actively used. The crocodile rewards people for having a go by playing funny roaring sounds and flashing the LED strip with coloured lights that increment through the strip with each recording interaction. We imagine that family members of different ages will use the crocodile together to record and play back content. The basic functionality enables users to create their own social games using the crocodile such as guessing games, 'pass the crocodile', 'crocodile says', and storytelling games.

The crocodile language friend was developed through a long-term, iterative co-design approach. This process has involved starting with the Ambient Birdhouse [78] to seed the design process, and creating 5 iterations of the design before reaching the current version. Design workshops and focus groups took place with the Reference Group to make decisions and give feedback on the designs, with each version being demonstrated in different places in the community so that people could experience it and give feedback, including with young children at a community centre. We are yet to trial prototype with children and families in their home, and a full discussion of the design process and evaluation is beyond the scope of this conceptual paper, but will be the subject of future work. This example represents one manifestation of a relational language technology, though we anticipate that there may be many other types of systems that reflect these attributes and address different aspects of a child's language learning needs. We offer this as a playful intervention into the language in the home setting that may open the space to other ways of engaging with language and design possibilities.

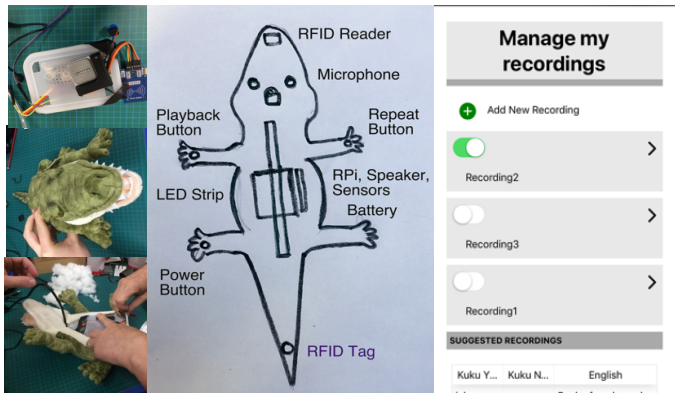

Figure 1: Crocodile Language Friend Design and Development

6.2.2 The Crocodile as a 'Relational Language Technology'

The Crocodile Language Friend serves as an example of a 'Relational Language Technology' and embodies the principles of a relational design approach in a number of different ways.

In terms of facilitating social interactions, we envisage groups of children interacting with the same crocodile together or playing together with their own crocodiles (Principle 1). Elders and children could record content together for the crocodile through the app, or family members could leave a message on the Crocodile Language Friend for children to take with them when they go away for the day (e.g. to kindergarten) or for longer periods (e.g. to boarding school). The intent of the Crocodile Language Friend is not to replace Elders as language teachers, but to serve as an engaging tool to support and reinforce language teaching and learning activities.

The Crocodile Language Friend web app invites users to create their own content (Principle 2) by adding entries consisting of a title and text and audio in any combination of English and Kuku Yalanji or its dialects. When users access the web app through their mobile devices, there is a dictionary lookup to check spellings, and a "suggested recordings" feature that proposes ideas for words and sentences to record next based on the previous topics (e.g. if a body part word is recorded, the system may suggest other body part words). This could invite personal contributions from family members in the form of single words or sentences, or a longer message such as a reminder, a joke, or a longer story or anecdote. Adults and children may record things together, or for each other through the app. To enable further customization (Principle 3), the web application allows people to set up the device with a custom crocodile name and a personalised greeting. While the initial prototype has been made with an off-the-shelf soft toy, women have been designing community-made crocodiles and other animals to create their own forms, with the hardware serving as a kit that could be fitted within different objects.

We have also designed the system in such a way that family members are the teachers rather than the technology (Principle 4). The crocodile asks children to answer a question or repeat a phrase in one language, leaves a pause for the person to respond, and then plays the corresponding recording in the other language. This invites the person to see for themselves if they have got the answer correct, or invites the feedback of other family members who overhear this interaction. This suggests that simple systems can facilitate social learning interactions in an interesting way without the need to equip the crocodile with complex artificial intelligence, by drawing in other language speakers around the technology who can provide the child with feedback and support.

The current prototype has the option of applying voice effects to the audio so that it plays things back in a high or low-pitched humorous voice rather than a human one. Community members found the crocodile voice humorous (Principle 5), and were more willing to record themselves on there, even for immediate family members, if their voices were not identifiable. We also observed that some children disengaged from the interaction when they heard an Elder's voice rather than the crocodile voice, perhaps because this gave it the quality of being an Elder rather than a peer. For each recording, the user can choose whether to use their own voice or apply the filter depending on the content.

Following the advice of Reference Group members, the Crocodile Language Friend prototype is small enough for young children to pick up and carry around with them (Principle 6). We imagine that if their children took their own Crocodile Language Friends to school or kindergarten, this could be used as a tool to communicate to educators what children have been doing at home, and adults could even record a message on the Crocodile Language Friend for educators. In the inverse case, the language teacher at school may encourage children to record particular words and phrases that they are learning at school on the Crocodile Language Friend through the web app, and then take them home to practice and show family members what they are doing in class.

The Wujal Wujal community chose the crocodile form for the Crocodile Language Friend as it is grounded in their local environment and thus connected to country (Principle 7), exciting for children, and Elders are keen to teach children to be safe around waterways. The Crocodile Language Friend could be loaded with sound effects from nature, and words and phrases that reflect the country that belongs to that particular family or dialect group. Fixing RFID tags around the community that can be read by the Crocodile Language Friends' could also encourage children to locate and interact with different places around the community. The latest version of the crocodile software allows people to record and play their own RFID treasure hunt game.

7 Discussion

We have identified a number of opportunities and issues relating to the design and use of relational language technologies, particularly in the context of Indigenous languages. Firstly, there is potential for RLTs to build on existing materials and resources. The Reference Group identified the need to leverage past efforts so that they are not duplicated and the language activities keep moving forward. RLTs such as the Crocodile Language Friend soft

toy and paired mobile app can help present existing materials such as the printed dictionary in a digital form in ways that are engaging to children, and create digital platforms for community members to keep adding to and maintaining the materials themselves. We imagine that in future the Crocodile Language Friends could be networked with each other and have the ability to share content between them. In this way, users could have the choice of creating recordings for their own child only, or sharing them with others via a broader community repository of recordings that continues to grow. However, in the current prototype, the use of local offline networks, and providing password protection on the Crocodile Language Friends, means that content is stored locally and owned and controlled by community.

Secondly, there is potential for RLTs to make language materials and practices accessible by leveraging existing devices and activities in the home. By designing technology to enhance existing interactions and routines within families, this does not burden Elders with coordinating additional community activities to use the technology. Additionally, the Crocodile Language Friend could help to make existing language materials freely accessible to community members through their own devices as a platform-independent web app. However, sustainable funding models would need to be explored for community to sew their own crocodiles and assemble new hardware kits. The Council expressed a desire to grow the digital skills and 'adaptive capacity' of community members to design, modify, and maintain language technologies into the future. A first step in this process has been organising computer coding workshops with youth to enrich their STEM skills and support pathways to higher education.

Thirdly, there is a need to foster ownership of RLTs by particular children and families to grow their use and consider ways to evaluate their impact. While community technologies such as noticeboards [78] rely on community champions at each site to upload and maintain their content, shifting the lens from community technologies to family technologies then repositions children and their families as more obvious 'owners' of the technology. It also taps into motivations of Elders to share their language with their own children or grandchildren, which may encourage regular ongoing content creation and use. This framing of RLTs as social technologies also refocuses questions of evaluation away from solely measuring language competency, to also considering people's engagement with the technology and in particular social interactions that foster language use.

This also creates the space for family members to be actively engaged in evaluating the social impact of RLTs in their own homes and their own children's language learning outcomes. Social learning theories could be drawn on to support evaluation, in which language learning happens "[…] as a collaborative performance between fluent speakers and learners" [79]. Underpinning much CALL work [80] is sociocultural theory, including Vygotsky´s notion of the Zone of Proximal Development (ZPD) [81]. This advances the notion that "language, first or second, is always learned and used in a social setting" and language learning outcomes are richer when learners interact with each other in language rather than by themselves [80]. The RLT perspective builds on this collaborative approach by foregrounding the importance of language interactions between different generations of language speakers.

8 Conclusions

The loss of a language constitutes the loss of a way of experiencing and understanding the world and our place within it. There is an urgent need to act to preserve, maintain, and revitalise Indigenous languages worldwide in response to diminishing speaker numbers, and technology design has the potential to positively intervene in this space. However, technology alone will not keep a language strong; people keep languages and Knowledges strong, and young people are the torchbearers for passing them down to future generations. The community involved in this project is proud of their language and culture, and it is a testimony to their resilience and courage that they are still bringing this knowledge to their children and grandchildren. This paper provides an empirical account of language teaching and learning as it currently happens in a particular community, and identifies possible design approaches to help communities with this type of language situation. Ultimately, it is through relations within communities, between communities, and with strategic partners that design efforts help carry these languages forward into the future.

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