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Moving ICTD research beyond bungee jumping: practical case studies and recommendations

Andy Dearden and William D. Tucker

Installing a network node in Mankosi.

The global spread of Internet and mobile communications has been accompanied by a growing interest in how information and communication technologies (ICTs) can contribute to social and economic development. There are a considerable number of such examples in developing countries. For example, M-Pesa in Kenya allows workers in the cities to send money back to families living in the countryside using SMS messages on basic mobile phones. In Ghana, the Motech project allows community health workers to use feature phones and network services to track ante-natal (and post-natal) care with the objective of improving outcomes for both mothers and babies. Other examples include Gram Vaani's (GRINS) open-source software for community radio stations, or Ushahidi's initiatives, which began with tracking post-electoral violence in Kenya in 2008 using mobile phones and Google maps. These examples illustrate different ways of leveraging ICT to improve lives and livelihoods world-wide. Such stories are inspiring many young (and not so young) researchers and innovators alike to explore how technology might support social and economic development and inclusion in global knowledge exchange.

Few of the researchers involved in such efforts come from situations and backgrounds where the technology is to be deployed. More typically, researchers from Western, industrialized, educated, rich, and democratic (WIERD) parts of the world make short visits to study a situation that they hope to influence, return to their home base to work on solutions, and return for further short visits to evaluate designs and prototypes. It is this kind of "bungee research" that we want to question [1].

In this work, ICTD refers to Information and Communication Technologies and Development, or Information and Communication Technologies for Development. The former construction "and Development" can be associated with studies of the processes and consequences of technology adoption, whereas the "for Development" formulation may be more appealing for engineers, setting the goal of devising technologies and establishing (socio-)technical interventions to contribute toward development [2]. ICTD is a growing research field with multiple conferences and journals (e.g., *Information Technology for Development, Information Technology and International Development*, the ICTD conference, the ACM Symposium on Computing for Development, the IFIP Working Group 9.4 Conference, the *Electronic Journal of Information Systems in Developing Countries*, etc.).

Introducing new technologies into social settings often generates surprises. A classic example has been the mass market adoption of Short Message Service (SMS), which was initially conceived as an internal service for mobile phone operator employees to use to communicate. "At the time it didn't seem like a big deal," according to Neil Papworth who sent the very first message [3]. In unfamiliar situations, the potential for surprising responses is higher. Initially promising interventions are sometimes later found to result in unforeseen and undesirable consequences. Consider the YayNay app. YayNay was developed as a social tool for teenagers out shopping to get feedback from friends about clothes that they were trying on. Early adopters were very enthusiastic and the developer was negotiating for major investment, until he discovered YayNay was being used by adult stalkers to collect pictures of semi-naked children [4]!

Unintended consequences are a common feature of ICTD. A recent project in Bangladesh introduced smart cards to pay bus fares with the objective of combating fraud and reducing waiting times. However, inflating fares was commonplace and widely accepted, and drivers' wages were very low. Bus drivers could not cope with the dramatically reduced income that resulted from the introduction of a cashless payment system. (Before judging, consider the social norm in North America where restaurant waiting staff receive very low basic pay, and generous tipping is a general social obligation on diners). What seemed like a simple technical change

resulted in significant industrial relations issues [5]. At times, technology can be a "double-edged sword" for the same individuals. Wakanuma [6] reports on the mixed benefits for women using mobile phones in rural Zambia, describing how husbands used call logs to monitor and track their wives' contacts.

Unintended consequences and mixed benefits are not the only issues of concern. Heeks [7] highlights the high rate of failures of ICTD projects, many of which are initially funded by external donors, but do not have sustainable financial models. Such projects provide income for technology providers and development consultants, but often fail to deliver long term benefits for the nominal beneficiaries. Such results promote cynicism and suspicion about the motivations of donors as well as those implementing such projects.

Getting Clear About 'Development'

Evaluating Development

ICTD is difficult for Engineers because the desired outcome (development) is ultimately a social, rather than a technical phenomenon. Worse still, "development" lacks a universally accepted definition. There is often ambiguity about whether "development" refers to an observable process that is naturally occurring within societies, or whether "development" refers to active interventions designed to move social conditions in particular directions. From either perspective, questions arise about what evaluation parameters to use.

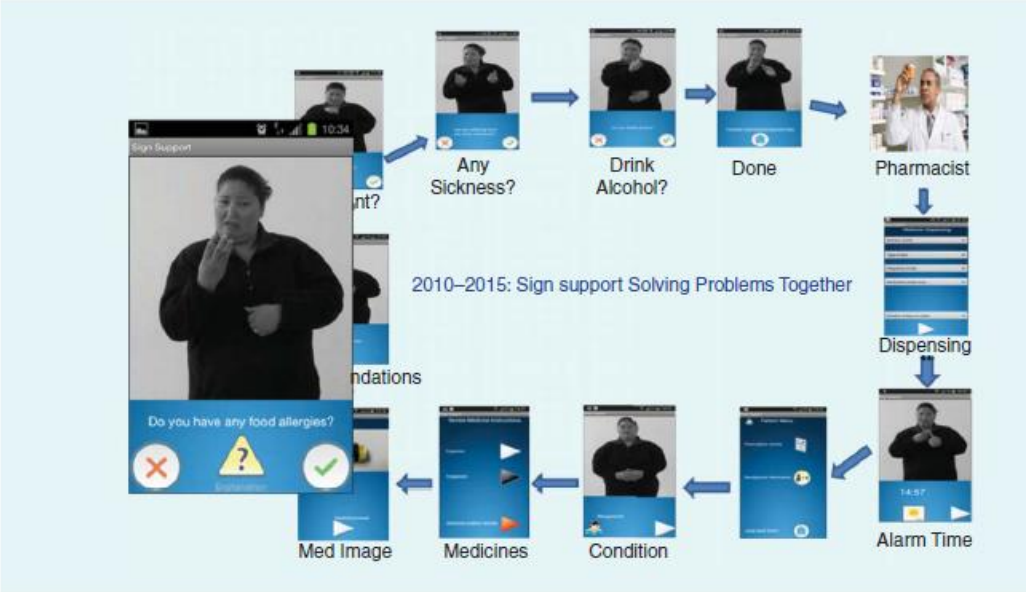

FIGURE 1. Sign support enables Deaf and non-Deaf users to conduct structured conversations around specific scenarios.

A view that was dominant and is still highly influential, links development primarily with economic growth, as measured by income/GDP/GNP. Perspectives such as "sustainable development" highlight how these simple financial measures ignore

the damage that so-called developed countries can cause to the global environment, and how people's life conditions can deteriorate despite increases in cash income. Purely financial views have also been criticized as neo-colonial for imposing models and policies on "developing" countries that are determined by the rich "developed" countries, and are shaped as much (or more) by donor interests rather than the interests and aspirations of the supposed beneficiaries.

"Human Development" advocates alternate metrics such as the Human Development Index (HDI), taking into account life expectancy, education, and income. The HDI was important in framing the United Nations' (U.N.'s) eight Millennium Development Goals (MDGs) that targeted: poverty, education, gender equality, child mortality, maternal health, HIV/AIDS, environmental sustainability, and global partnership. The range of parameters has been broadened further in the Sustainable Development Goals adopted by the U.N. in 2015.

A growing perspective is the "capabilities" approach, which views development in terms of the freedom of people to live lives they have reason to value [8], [9]. The capabilities approach argues that ultimately our lives improve when we have more opportunities and choices and are able to take advantage of those choices. Poor health, poverty, lack of education, environmental damage, etc. are all factors that limit such freedom, but so are oppression, discrimination, and exclusion from decision making. The capabilities approach emphasizes the rights and capacities of people to participate in shaping their own futures at individual, family, community, regional, national, and international levels. When development is understood in these broader terms, the question of how ICTD researchers and engineers interact with the communities they claim to be supporting demands careful scrutiny. If development is about people's self-determination, then the processes used in ICTD must promote rather than subvert local capacities for problem solving and innovation.

Evaluating ICTD Research

Heeks [7] highlights the high frequency of failure in ICTD initiatives, and attributes these failures to "design-reality gaps" arising because decision makers and engineers lack sufficient understanding of context. To understand the context of use for ICTD, it is common for researchers and engineers to conduct field study visits to inform their research and design. Much of this work, particularly in research, involves short visits by external researchers from relatively privileged situations or foreign countries to investigate problems and generate ideas. These may be further developed back at the engineers' home base before return visits for deployment and evaluation. Such research activities are not necessarily ethically neutral exchanges of information, and the arrangements, structures and relationships surrounding these interchanges should be critically examined.

Researchers in development studies have highlighted the problem of "development tourism" [10] where rich and privileged people gain valuable experiences through short visits to exotic locations, but the people hosting the visits see few substantive or sustainable benefits. Health and social science researchers have been criticized for "parachute research" [11] where external researchers make short visits to gather data, analyze the data elsewhere, make recommendations, and further their careers. The imported service might offer high levels of rigor, but undermines the development of local research, innovation, and knowledge capacity that is essential for turning findings and recommendations into sustainable change. In community development, Mary Brydon-Miller has used a stronger simile of "bungee research" [1]. Bungee research is too common in ICTD.

Is Bungee Research Effective and Efficient?

Bungee research is not only inefficient in its use of resources, paying high salaries and travel costs for visiting researchers who lack local knowledge. It also may be less effective than supporting local talent. It also runs the risk of causing direct harm through ignorance of local socio-cultural norms. Foreign researchers visiting deprived and marginalized communities are seen as important visitors and can leave a significant "footprint" in the communities where they interact. Sambasivan *et al.* [12] describe how the seemingly very small gift of a school bag to one family as a "thank-you" for participating in research resulted in significant anger and jealousy in a deprived community. Dearden [13] describes a (fictionalized) encounter where a visiting European professor is unwittingly recruited to provide symbolic endorsement of a local politician, risking the efforts of a partner non-governmental organization (NGO) to avoid local political conflicts. One NGO director used the term "hit and run researchers" [13] to refer to a group whose behavior had damaged relationships of trust between the NGO and the community that had taken years to develop.

When research is led by people who are unfamiliar with a specific social and cultural setting, and may not even speak the local language, the reliability and validity of such research data (and decisions based on that data) should be questioned. In a perfect world, people who are marginalized would have the innovation skills to address their own challenges. However, technical innovation increasingly requires distributed networks of expertise, from which they are also often disconnected. Some innovation in ICTD will continue to occur outside of the local context, with engineers spending only part of their time at field sites. In what follows, we examine the evolution of two projects in South Africa to illustrate how ICTD research might begin to move beyond bungees.

Case Studies

One of the authors (Tucker) has been involved with two community-based ICTD projects for more than ten years each. Both projects have involved degrees of

bungee research, but the approach to visits and interactions with the communities has evolved over the life of the two projects. Yet there are similarities. Both projects have evolved to include some form of consistent, long-term research presence. Also, in both cases, we have developed an increased awareness of the implications of bungee research, to the extent of now making deliberate choices about when to be present and when to be absent from a field site. In this article, we want to focus on our experiences of bungee research. More details about the technologies developed are available online.

Assistive Technology for Marginalized Deaf People in Cape Town

The first project, called SignSupport (see http://www.sign-support.org), focuses on designing assistive technology to support members of a Deaf person's organization (DPO), or NGO, called Deaf Community of Cape Town (DCCT). In the early work, starting around 2001, contact with DCCT was sporadic being restricted to visits to conduct initial design studies, to test out various technologies with one or more Deaf[1] users, and to collect feedback. This mode of working, in hindsight, was adopted based primarily on *ignorance* in the strict sense of being uneducated, unaware or uninformed about the participatory critiques of the positivist training we had absorbed as human computer interaction (HCI) researchers.

In 2004, we began a longer-term community intervention by establishing a computer lab in the Deaf community center. To suppor t the facility, a senior researcher and one or more postgraduate students visited the center every Wednesday to try out various technical research ideas and to solve technical problems in the lab. The weekly visit pattern established in 2004 has been maintained to this day and has had a lasting impact on building and maintaining trust between a revolving cast of researchers (as students graduate and new ones are recruited) and the Deaf community living in proximity to that community center.

There have been several constants over the past 15 years. Firstly, the main players who run DCCT are still in place. Secondly, the academic who initially introduced us is still working with DCCT, and with us, and can act as an advisor, mediator, or "honest broker" if relations become strained for any reason. Thirdly, two of the academic supervisors continue to manage postgraduates working on the project at their respective local universities. This long-term collaboration has resulted in mutual trust and genuine friendships. Although weekly visits could be seen as localized instances of bungee research, the relationships underpin tolerance and willingness to find solutions associated with the inevitable hiccups caused by bringing computer science students with often limited social skills (and often different social backgrounds) into a disadvantaged community.

[1] Deaf with a capital 'D' refers to a social grouping of people that primarily use signed language to communicate. In our case, DCCT members are particularly ill-equipped for spoken and written languages, and there are eleven official such languages in South Africa; hence an emphasis on Deaf people rather than deaf and/or hard of hearing.

As the relationships have developed, the nature and focus of the weekly visit has also changed. After a couple of years, the Wednesday morning session became recognized as the time that researchers visited, and Deaf people started to avoid the lab at that time. Now, instead of testing new technologies on Wednesdays, we schedule other times for participant engagement and research sessions. Instead, we attend weekly to support accredited computer literacy training, and to assist the Deaf technical support staff (see below).

We had thought that a monthly social gathering would be an ideal opportunity to conduct surveys with larger numbers of Deaf people, only to find that the Deaf people did not want to compromise the social nature of their event. They preferred that we arrange other times that did not overlap with those monthly sessions. We also hired a small number of Deaf technical support staff to keep the lab open for 5 or 6 days each week. As one of the support staff began to assume more complex system administration duties, we deliberately avoided being on site too often. If researchers were present, then we would simply fix problems as he watched. Instead, we provided email, SMS, and instant messaging support for him during the week, and would only visit on Wednesdays or help solve catastrophic problems such as losing network connectivity. This avoids undermining his local status as system administrator and lab manager. We also hired two Deaf assistants (only one of whom has continued) who also collect statistics on how people are using the computers, e.g., job hunting, watching videos, email, etc. This supports both our research and the DCCT management. The Deaf team developed its own system for recording usage, including using a spreadsheet to relay the information to us. This regular reporting also provides regular communications operating in parallel with bungee research visits.

Perhaps the biggest evolution over the years is that the academic supervisor overseeing the whole project (Tucker) has chosen to appear less often. In the early days, he attended each week; now it is monthly or less. The main reason for the supervisor to "back off" has been to hand over more local responsibility and ownership to the Deaf community and more experienced students working on the project.

Currently the main assistive technology product that has been developed with DCCT is SignSupport [14]. This mobile phone app combines "packaged" videos of South African Sign Language (SASL) with a simple UI navigation and can be used to support structured conversational scenarios. A demonstration system supports conversations between a pharmacist and a Deaf user when prescribing drugs (checking whether the user is pregnant, taking other medications, explaining quantity, timing, etc.). Sign Support has been successfully demonstrated as a prototype, and a workbench has been developed to specify and edit new types of structured conversation. Next steps involve re-engineering the student prototypes to

bring the platform up to production standards, and negotiating the (medical) regulatory and legal liability issues around distributing such an application.

Rural Telcommunication Services in the Eastern Cape

Whereas the Deaf community center is only a half hour drive from our campus, the second project, called Zenzeleni (see http://zenzeleni.net), is based in the Mankosi community in the Eastern Cape, a 16-hour drive, which takes even longer if the bus has to be used. In this remote area, we are exploring affordable, and solar powered, voice and Internet services in a rural community. Over the years, we have significantly modified the way in which we visit the site, with a trend towards fewer yet longer visits.

We began with very short visits following the operating procedure of the organization that originally invited us to the site to explore applications in tele-health. Representatives of that organization would stay in a guest house 2-3 hours drive from the site, visit daily and return to the guest house in the evening. We adopted a similar model for visits primarily by *emulation* of that existing relationship. We soon started staying out on site, and spent social time with participants, deepening the personal and professional relationships beyond the working day. By 2004, we relocated our work to another community in the same province, still focused on telehealth.

At this new location, we stayed on site from the beginning. We were fortunate in that there was a backpackers' hostel in the area and the length of our visits increased so that 7 days or longer became typical. Instead of depositing a new prototype and rushing through a one-day training exercise, we could install new technology, conduct training, and stay to catch problems and collect feedback. We also befriended collaborators and often stayed with participants at the hospital, about one hour's drive from the backpackers' hostel on a rocky dirt road. Visits increased to last two and three weeks, and while we mostly stayed at the backpackers' hostel, we often spent 2–3 days at a time sleeping over at the hospital.

By 2012, we were only visiting twice a year, and had someone living and working on site for up to several months at a time. Again, collaborators influenced us. The collaborator was an ethnographic technologist (Dr. Nic Bidwell) who became associated with the project in 2008. She lived in one of the outlying villages for months at a time, and later moved semi-permanently to the main village [15]. Subsequently she collaborated with a series of related ICTD studies, exploring how local inhabitants use mobile phones, designing an audio repository to help village leaders record meetings, and introducing a moveable solar solution for phone charging. Influenced by Nic's approach, working with tribal community

leadership rather than working only with NGOs, we then had a Ph.D. student semi-resident in the village (not at the hostel), and while bungee jumping mostly ceased for him, we still send other postgraduate students to the site on a periodic basis.

Various factors influenced these changes. Most importantly, as our relationships developed, we were more able to respond to community needs and allow community interests to drive a shared research agenda [16]. Our focus has moved from rural telehealth to a community-driven wireless mesh network. Members of the community have now formed a co-operative and we have supported them through the legal process of establishing the co-op as a licensed telecoms provider for the area. With a long-term team member in the field, we can also send out new team members for several weeks at a time for mentoring on site. These team members are accepted by the community as part of the research project umbrella. We notice that those students coming from similar cultural backgrounds to the community and speaking the language gain acceptance more rapidly and are sometimes able to uncover the root of issues more quickly than even long-term resident researchers.

The shift from bungee jumping to a semi-permanent presence has provided numerous benefits regarding ethnographic understanding, training for researchers, data collection, capacity building, and troubleshooting. However, it is not without perils. One risk is that local support can become too reliant on outsiders, detracting from local community ownership ("why should we use the white man's network?"). Reflecting our experience in the Deaf project, we are striving for a similar relationship with the rural community. When we are completely absent from the field, we provide remote advice and support and encourage the local support team to solve problems on their own. For example, when we discovered that the antennae purchased for the rural network were not powerful enough for 5-km links, we bought new antennae and shipped them out to the site. We encouraged the local support team to do the replacement themselves, and in doing so, they devised their own solutions for protecting the equipment from rainwater and high winds.

For this case study, the primary supervisor (Tucker) has also reduced the number of visits from 4-5 per year to one or even none per year. This is because the local community has been more active, and the resident Ph.D. student has taken on more ownership and mentoring. The supervisor's role now is representing the university within the community and drawing on the long-term relationships to smooth over the infrequent bungee jumping. Also email, phone, and on-line contact with community members makes this possible.

The Zenzeleni project has provided phone battery charging, free in-network calls, and drastically reduced price out-of-network calls since mid-2014. The community-based cooperative maintains the network and collects the revenue, which stays within the community. We are exploring how to best replicate the model for other communities. The main challenges are to figure out how to bootstrap additional community networks financially and then how to support them from afar, e.g., providing a cloud-based umbrella support organization.

Alternative Models Possible

Many engineers, designers and researchers are motivated by a genuine desire to make the world a better place. Seeing vast inequalities in power, wealth, and freedom across the world, they are keen to apply their skills and knowledge to improve people's lives and livelihoods. It is certainly the case that some technical innovations with ICTs can be highly beneficial in a wide range of settings. However, simplistic media stories of technical solutions delivering transformational change lead to serious misunderstandings of the relationship between technical innovation and meaningful sustainable development.

Toyama [18] provides a detailed critique of the limitations of such "shrink wrapped" interventions as a strategy for fostering development. As Sahay *et al.* [19] observe, the major challenges for ICTD research are not in achieving huge technical leaps. Change lies in the capacity of individuals and organizations to understand and articulate their challenges, and to explore, devise, evaluate, and select appropriate technological responses. For marginalized communities to have a voice, they need opportunities to develop an appreciation of technologies, just as researchers and designers must develop a deeper appreciation of the communities and organizations they hope to assist.

We have argued elsewhere [20], [21] for approaches that involve people working in two distinct but complementary roles. One group, spends extended periods in a specific setting to lead local changes of organization and practice, i.e., being "situation focused, but technology aware." They are supported by a secondary team (which may be based elsewhere) that is "technology focused but situationally aware" [20]. At some points, software and hardware developers might make one or more bungee visits to the site, but this happens in a context where (at least) one member of the team is already embedded in long-term relationships.

Taking a broader view of development arising when people increase their own agency and capabilities, we argue that alternative models of ICTD are possible. To achieve such changes, the model that has evolved in SignSupport and Zenzeleni involves long-term partnerships maintained over years rather than days, weeks, or months. Occasional "bungee" visits can be used to address specific short-term objectives, but the visits are framed by a critical set of relationship practices that alter the dynamic of these interactions. Specifically:

- the research team maintains a parallel consistent

presence and relationship with the community who are active participants in the research;
- research agendas are negotiated with and guided by the priorities of the community;
- mentorship is made available to help novice researchers develop their social awareness in the new setting, and experienced managers avoid sending researchers to field sites before their social skills have reached an appropriate level;
- the visitation plans form part of a gradual, planned, and open transfer of responsibilities and project ownership towards other actors including local community members or other researchers (e.g., senior students); and
- occasional visits are made by senior research leaders to demonstrate the ongoing commitment of partners to the work and to maintain long-term strategic relationships.

Bungee Jumping Can be Worse than No Research at All

ICTD research will remain a geographically distributed activity that is likely to include occasions where privileged researchers make short-term visits to very different cultural settings to work with people who are marginalized from dominant structures in global social arrangements. We contend that the primary use of bungee jumping for ICTD research is ineffective and unethical. More detailed discussion on this can be found in [22]. Such an approach is unlikely to generate results that are meaningful for development, and carries risks to vulnerable stakeholders that external researchers are often ill equipped to recognize. Placing bungee jumping at the heart of a project will typically be worse than no research at all.

There is an urgent need for a culture change in ICTD research, and this should be reflected on ethics committees and institutional review boards (IRBs), and in the content of relevant courses [20]. The topic of bungee jumping and participatory research approaches should be introduced in a typical "Technology and Society" course, and re-emphasized in post-graduate research methods training. While the case studies in this article can serve as initial examples, the ICTD literature has numerous case studies where varying degrees of bungee research can be discerned. For orientation, the digital artwork "http://whitesave.me" may stimulate some critical reflection. Actors in the broader field of ICTD implementation (i.e., action by NGOs, aid agencies, and other organizations innovating and applying technology to development challenges) should examine how resources are used and how decisions are taken so that systemic and sustainable capacity building is prioritized.

In our work (and the work of some, but sadly too few, ICTD research groups) we have found that models emphasizing long-term partnership and continuous engagement are more likely to lead to sustainable outcomes both in the research

setting and through transfer of knowledge to other situations. Such models move us and our beneficiaries beyond bungee research, and enable our joint work to be situated, or at least situation aware – enabling benefits from the sustained interactions when the bungee researchers leave.

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Author Information

Andy Dearden is with the Cultural, Communication & Computing Research Institute, Sheffield Hallam University, Sheffield, S1 1WB, U.K. Email: a.m.dearden@shu.ac.uk.

William D. Tucker is with the Department of Computer Science, University of the Western Cape, Bellville, South Africa. Email: btucker@uwc.ac.za.

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