Institution: Swansea University
Unit of Assessment: 11 - Computer Science and Informatics
Title of case study: Empowering rural digital communities in the developing world and the UK

1. Summary of the impact

Research in the area of mobile digital storytelling conducted at Swansea University has shown that hundreds of millions of people are disempowered by lack of appropriate digital devices, services and infrastructure. In a programme of research starting with real users in communities in rural India, Southern Africa and rural UK, we designed, developed and tested new systems, leading to the integration and delivery of new techniques and platforms by major service providers, including IBM. Open source software developed to simplify media creation and sharing is being used by communities around the world, and has been downloaded more than 14,000 times. The research has increased awareness of "digital divide" issues and has changed attitudes in technology companies and public audiences.

2. Underpinning research

The underpinning research was carried out between 2006 and 2012 in a series of related projects concerning the digital divide, beginning with the StoryBank project, reported in [R1], an international peer reviewed long paper in ACM CHI.

From the outset our research was conducted with representative end-user communities (e.g., Budikote, India, population 3,000) and partner organisations (NGOs, local offices of Nokia, IBM and others). Impact was therefore embedded into the research rather than arising in post hoc "evaluation" after the development had concluded.

Research findings showed that mainstream, user-generated content services were inappropriate for communities with any of the following characteristics: lack of a digital network or bandwidth capacity; relatively low access to standard computing facilities; low amounts of locally-relevant digital content; low computer literacy; or low textual literacy. Such communities, which we worked alongside, are found across developing world regions (e.g., rural India, Africa, Central America) as well as in some areas of developed countries (e.g., rural Wales).

We established that, while the mobile phone is available to many people, regardless of region, mainstream media production and sharing features do not provide usable and useful ways for these communities to interact — as they are designed with a "first world" perspective.

To address this deficiency, we designed and developed on-phone, user-generated content capture and editing software structured in a way tailored to the communities' capabilities and requirements. This work also defined the relevant characteristics, thus enabling principled design for diverse communities.

Similarly, while mainstream users can upload content to remote providers such as Facebook, our target communities need alternative methods to collectively produce and access equivalent content due, for example, to poor bandwidth or lack of literacy. To this end, we researched ways to make local content repositories effective [e.g., R2].

We also investigated access mechanisms to search and browse content. Speech and other audio, along with images, were seen by the communities as important ways of supporting the navigation task [R1-R3], overcoming the lack of textual and computer literacy: e.g., users can listen to information rather than have to read it, and content filtering can be done by nested menu selection using icons rather than text labels.

We also found that bandwidth connection limitations and lack of affordable data plans mean that many users do not have the sorts of mobile information access that affluent users take for granted. We identified the value of local networking and providing sophisticated interactions over basic

telephone line, and researched how to overcome these barriers through cheaper transmission methods, including content caching, Bluetooth, and the telephone network, combined with our improved, more accessible, user interfaces [R3].

The work has been carried out in multi-disciplinary teams involving UK universities, UK and overseas NGOs and industrial partners in 15 multi-site funded projects from 2006, and is still ongoing. At Swansea the key researchers involved were: **Prof Matt Jones** (2006-present); Dr **Simon Robinson** (Research Officer, 2006-present); Dr **Will Harwood** (Research Officer, 2006-2008); **Mark Davies** (Research Officer, 2010-2012). Our focus in these multi-site projects was on interaction design and technical prototyping.

3. References to the research

Authors from Swansea Unit of Assessment indicated in **bold, *italicised where an author has subsequently left the institution*.**

[R1] David M. Frohlich, Dorothy Rachovides, Kiriaki Riga, Ramnath Bhat, Maxine Frank, Eran Edirisinghe, Dhammike Wickramanayaka, **Matt Jones**, and ***Will Harwood***. 2009. StoryBank: mobile digital storytelling in a development context. In *Proceedings of the 27th international conference on Human factors in computing systems* (CHI'09). ACM, New York, NY, USA, 1761-1770. DOI=10.1145/1518701.1518972

The ACM CHI Conference is the premier venue for research in the field of Human Computer Interaction. This article is a full paper; the acceptance rate was 25%.

[R2] **Matt Jones**, ***Will Harwood***, David Bainbridge, ***George Buchanan***, David Frohlich, Dorothy Rachovides, Maxine Frank, and Mounia Lalmas. 2008. "Narrowcast yourself": designing for community storytelling in a rural Indian context. In *Proceedings of the 7th ACM conference on Designing interactive systems* (DIS'08). ACM, New York, NY, USA, 369-378. DOI=10.1145/1394445.1394485

The ACM Designing interactive systems conference is a premier arena for contributions that shape the future of interactive systems design and practice. This article is a full paper; the acceptance rate was 34%.

[R3] **Simon Robinson**, Nitendra Rajput, **Matt Jones**, Anupam Jain, Shrey Sahay, and Amit Nanavati. 2011. TapBack: towards richer mobile interfaces in impoverished contexts. In *Proceedings of the 2011 annual conference on Human factors in computing systems* (CHI'11). ACM, New York, NY, USA, 2733-2736. DOI=10.1145/1978942.1979345

The ACM CHI Conference is the premier venue for research in the field. This article is a peer reviewed technical note; the acceptance rate was 27%.

[R1,R2] present the StoryBank system. This work represents the starting point and basis for a series of further collaborations and projects in India, South Africa and rural UK that have elaborated the insights and innovations described in (Section 2), above. We have developed innovative access techniques (e.g., tapping on the back of a device) to overcome network and user limitations [R3].

The research has been funded by EPSRC grants: EP/E006396/1 StoryBank: Sharing stories across digital divides (PI: **Matt Jones**; 2/10/06/ - 1/7/08, £79K); EP/E006418/1 Bridging the Global Digital Divide Network; (PI: **Matt Jones**; 01/9/06 – 31/8/09; £79K); EP/H042857/2 Community-generated media for the next billion (PI: **Matt Jones**: 01/8/10 – 31/3/12; £449K); EP/H010394/1 Telling the StoryBank: An Exhibit for the British Science Association, Festival of Science 2009 (PI: **Matt Jones**; 06/7/9 – 05/9/09; 16K); EP/J000604/1 Scaling the Rural Enterprise (Co-I: **Matt Jones**; 01/10/11 – 31/9/14; £523K [Swansea award]); EP/I001778/1 Bridging the Rural Divide (PI: **Matt**

Jones; 01/10/10 – 31/8/12; £134K). Research partners in UK were University of Surrey, Glasgow and Nottingham Universities.

4. Details of the impact

The toolkits developed from the research have delivered societal, economic, and public engagement impacts:

The ***StoryBank system*** was successfully deployed in Budikote (pop. 3,000) and used to create and share content, including education and healthcare contributions. The Head of Nokia's India Research Center said:

> *"On the practical level, we found the model implemented by StoryBank, related to running ICT for Development projects in collaboration with a local NGO, to be a fruitful one. We implemented the same model in several of our future projects in rural India… In sum, the Nokia internal impact of the collaborations around the project StoryBank was significant… From the point of view of a company such as Nokia, this insight can also be transferred to real value through digital products aimed at the Bottom of the Pyramid market."*

The process for securing impact was greatly facilitated by collaboration with IBM. StoryBank was instrumental in Jones receiving an **IBM Faculty Award** (2010), recognising the impact of the work on end-users. Since the Award, with IBM Research India, we developed the TapBack system [R3], providing novel ways for end users to access spoken content; and, ACQR (a telephone based sharing service). A Senior Researcher at Spoken Web, IBM Research India, said:

> *"We collaborated with Swansea due to their track record in information interaction for bottom of the pyramid users. The systems they have developed with us since 2010 have been available to hundreds of farmers in a geographically dispersed area in Gujarat state. The TapBack and ACQR services remain integrated into our live services for those communities to date"* (March 2013).

Farmers improve each other's productivity using the services. TapBack led to a **patent submission** by IBM Research India. StoryBank findings helped **win funding** for two software toolkits (along with partners). The first, digitaleconomytoolkit.org, supports user generated content creation especially in constrained contexts. Since its launch (July 2012) the mobile phone application has been **downloaded 14,190 times** (to July 31st, 2013). Independent logs show many regions have been reached: USA (27% of downloads); Philippines (11%); India (8%); and Saudi Arabia (3%).

Following **national media coverage** of our work in India, Valley Kids contacted Swansea. Building on our research [R1, R2] we developed an interactive kiosk for the *Rhondda Lives! Archive* of user-generated content; this toured the Welsh Valleys in 2008, spent a month in the Wales Millennium Centre (annual visitors >1M) and exhibited in the Rhondda Heritage Centre for 3 months.

The second toolkit, ***Placebooks***, enables people to create and access content in flexible, resource appropriate ways. The platform was integrated into the People's Collection of Wales (PCW) service. The Online Digital Manager for PCW said:

"The development of Placebooks has been particularly useful for the PCW as it has offered a solution to the demand from groups such as the Ramblers that have felt frustrated by the lack of flexibility of the core PCW trails system…" (it) *"showcased at a Ministerial level with a launch at the National Eisteddfod in the Vale of Glamorgan in 2012… the Placebooks system, hosted by the People's Collection Wales on an Amazon Web Service cloud server, has been widely promoted and there has been a great deal of interest from a wide range of potential users and partners in Wales and across Europe."*

Changes to Awareness and Attitudes: In July 2012 the toolkits were launched at the Royal Geographical Society (London, 63 attendees), and in March 2013 in Cape Town with 57 attendees — both events included NGOs and commercial enterprises. 83% of the London respondents (N=18) and 95% of Cape Town respondents (N=38) said the work had changed their awareness of

digital inclusion issues; 61% (London) and 76% (Cape Town) said the toolkit work had positively changed their attitude to the sorts of approaches in the toolkits.

> *"I was very inspired by the presentation and the organisation I am part of, ACHA (The African Centre for Heritage Activities) has now decided to integrate the use of the toolkit — Android phones as well as the tablet platform — into a project we are starting in August"* (Cape Town, attendee).

The StoryBank system was selected for the National Science Festival (2009) and approximately 1,000 visitors used the system. Survey comments and data indicate impact: e.g., 75% of respondents to the questionnaire (N=50) agreed or strongly agreed that the work had impacted on their awareness of digital divide issues. The research has impacted through The Royal Society of Arts, which used user generated content from the StoryBank trials in their Student Design competition and sent winners to Budikote in 2008.

The Engineering and Physical Sciences Research Council highlighted the research as an exemplar in its "Impact on Society" series, and the research also featured as an EPSRC Impact! example on the UK Collaborative on Development Sciences (UKCDS) website.

5. Sources to corroborate the impact

1. Former head Nokia Research India. Nokia Research India.
2. Valleys Kids! Storybank kiosk : http://www.katrinakirkwood.org/RLWebsiteFinal2/index.html
3. Visitor numbers Millennium Centre: http://wales.gov.uk/newsroom/tourism/2012/6121735/?lang=en
4. Com-Me Phone Application download indicator (https://play.google.com/store/apps/details?id=ac.robinson.mediaphone). Full auditable logs available on request, snapshot July 2013.
5. Online Manager, PCW http://www.peoplescollectionwales.co.uk/; http://placebooks.peoplescollectionwales.com/. (Placebooks impact)
6. Senior Researcher, IBM Research India
7. British Science Festival (http://www.tellingstorybank.info/)
8. EPSRC Impact in Society promotional flyer
9. Director, The African Centre for Heritage Activities, South Africa (email to SA Partner).
10. FutureLab Social Inclusion policy document, StoryBank as case-study: http://archive.futurelab.org.uk/resources/documents/handbooks/designing_for_social_justice2.pdf