

# Ethical Challenges in the MOSAIC 2B project

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## ABSTRACT

The MOSAIC 2B project aims to unleash business opportunities for micro-entrepreneurs in rural areas of South Africa by providing them with entertainment and educational media content. For this purpose, the cinema-in-a-backpack kit is able to receive and screen media content and operate a small business. Delay Tolerant Networking (DTN) is used to transfer the content, cost effectively, from urban areas to recipients in the rural areas. The mobile cinema is the use case for DTN and the facilitator in creating micro-enterprise opportunities for local entrepreneurs. This paper presents ethical challenges and implications that have to be addressed in order to connect rural communities in South Africa and provide them with cinema experience.

## Categories and Subject Descriptors

K.4.1 [Public Policy Issues]: Ethics, Privacy, Regulation

## General Terms

Management, Documentation, Design, Economics, Experimentation, Human Factors, Legal Aspects.

## Keywords

MOSAIC 2B; Mobile cinema; Delay Tolerant Networks.

## 1. INTRODUCTION

The MOSAIC 2B project [1] aims to unleash business opportunities for micro-entrepreneurs in rural areas of South Africa by providing them with entertainment and educational media content. For this purpose, low-cost devices have been used and a DTN network [2] has been designed to deliver content from urban areas to recipients in the rural areas. In this way micro-entrepreneurs are provided with an easy-to-use cinema-in-a-backpack kit that allows them to download the content and screen it and to operate a small business for this purpose. Such an experiment and its related research activities introduce a number of potential ethical concerns, which are presented in this paper. Based on the assumption that any scientific research has some degree of risk by its nature, that is, investigating the unknown, the project team has carefully considered risks. This project attempts to conduct responsible research with clear and complete recording of research procedures, results, and analysis; and care for the ones who may be affected by such a research project. In



Figure 1: The MOSAIC 2B scenario; DTN networking between the bus station in the city of Pretoria and the rural bus station in Kwagagfontein.

this paper, which follows from our previous work [18-19], we provide a general overview of the MOSAIC 2B scenario in Section 2. In Section 3 we present the main ethical issues that have been identified and addressed in such a research project. A brief summary of related work is provided in Section 4. Section 5 concludes the paper.

## 2. MOSAIC 2B SCENARIO

MOSAIC 2B is a research project aiming to provide business opportunities for micro-entrepreneurs living in rural South Africa by delivering multimedia content to them in a low cost manner. Since cellular data access is usually unavailable, slow or expensive in rural areas, content delivery is performed using DTN. Figure 1 gives an overview of the project. Content is delivered from the city of Pretoria to Kwagagfontein, a small town located >100km from Pretoria that serves several rural areas. Buses usually travel between the two locations in pre-determined routes, for three hours in the morning and three hours in the evenings. The buses travelling between these two locations will act as carriers of data. This is achieved by placing low cost WLAN-enabled devices, named infostations, in the buses and bus stops at both locations (see Figure 1). In the rest of the paper, we refer to the infostations placed in the stops as fixed infostations and the infostations placed in the buses as mobile infostations. Initially, content is stored in a

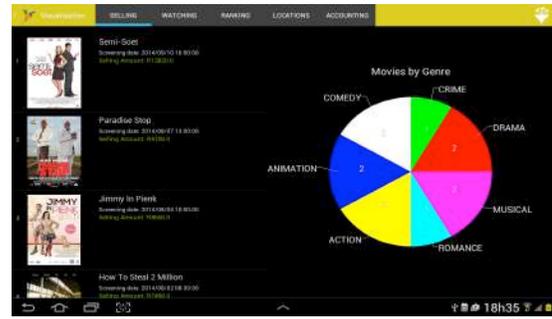


**Figure 2: Cinema-in-a-backpack system (left) and mobile infestation (right).**

fixed infostation located in Pretoria. When mobile infostations come in contact with the fixed infostations, i.e., when buses arrive at the bus stop, data is forwarded to the mobile infostations via DTN (see Figure 1). The mobile infostations act as data mules and transport the content between the infostation in Pretoria and another fixed infostation in Kwaggafontein. Micro-entrepreneurs in the areas near Kwaggafontein are equipped with cinema-in-a-backpack systems that allow them to obtain content from the fixed infostation in Kwaggafontein and screen it.

The infostations (fixed and mobile) are wireless routers equipped with a USB hub, battery supply, external memory, and 3G dongle (see Figure 2 (right)). The 3G dongle is used whenever cellular network is available to send system activity to the central server in Pretoria. This provides some monitoring of the system and enables the support teams to detect failures. The fixed infostations are connected to the power system of the bus depots, while the mobile infostations can eventually be connected to the battery of the vehicles. The cinema-in-a-backpack carried by the entrepreneurs consists of the following components: a tablet, a projector, speakers and a battery. The tablet allows the entrepreneur to obtain the content from the fixed infostation at Kwaggafontein. The projector is connected to the tablet via HDMI/VGA. A battery is provided for use when power supply is not available. The components of the cinema-in-a-backpack are shown in Figure 2 (left).

The Mobile Player Platform (MPP), a working environment which allows the micro-entrepreneurs to use the cinema-in-a-backpack device and run their business, has been installed on the tablets. The MPP provides a large set of functionalities such as, ordering and paying for movies, scheduling cinema events, and screening the movies. Besides, the MPP hosts a visual analytics component, a software component that provides the micro-entrepreneurs with valuable information about his/her business activity (a screenshot of the screening report from the visual analytics module is in Figure 3). The micro-entrepreneurs' activity is logged by the MOSAIC 2B Control Unit (MCU), a remote server which coordinates and monitors the entire MOSAIC 2B system. Such control unit handles all the micro-entrepreneurs' requests and their transactional interaction



**Figure 3: Screening report from the MPP visual analytics showing its own business activity**

with the system. Besides movies, the MCU transfers analytical data to the MPPs via the DTN network.

### 3. ETHICAL CONCERNS

In this project, we recognize and address important ethical issues that must be considered in any research project in such settings. Aspects such as voluntary participation, consent process, privacy, anonymity, confidentiality and the “no harm” principle are presented in the following sections.

#### 3.1 Voluntary Participation

Although all of the participants, namely the micro-entrepreneurs, in the MOSAIC 2B project are adult volunteers, the MOSAIC 2B experiment offers incentives to the micro entrepreneurs to participate in the 6 month field experiment to test the cinema-in-a-backpack. These incentives include the actual equipment (cinema-in-a-backpack), a competition among the micro-entrepreneurs offering additional equipment as prizes as well as business and technical training. Considering the ethical implications of using incentives we firstly need to look at the meaning of incentives. An incentive is an offer of something valuable meant to influence or to alter another person's course of action [16]. The person offering the incentive therefor means to make one choice more attractive to the person responding to the incentive than alternative decisions. Both parties therefor stand to gain from the resulting choice. There is considerable confusion regarding the ethical appropriateness of using incentives in research with human subjects. Some consider incentives as unethical causing undue influence (corruption of judgment). In [17], Grant and Sugarman show that, for the most part, the use of incentives to recruit and retain research subjects is harmless. They do however go further to identify instances in which incentives become problematic. These instances include cases where the subject is in a dependency relationship with the researcher, where the risks are particularly high, where the research is degrading, where the participant will only consent if the incentive is relatively large because the participants' actual aversion to the study is strong and where the aversion is a principled

one. Taking these guidelines into account, and with due recognition of the challenging context in which the participants live, and the demands of participating in the project, stakeholders agreed that participants would (and should) receive the equipment at the end of the experiment to keep for their own purposes. This was documented in the Service Level Agreement (SLA) proposed and discussed with participants from the first contact workshop where the project and their required participation were detailed.

The equipment consists of the entire cinema-in-a-backpack as shown in Figure 2 (left). The promise of equipment in exchange for participation may well have influenced their decision to participate. This ethical risk was however mitigated with the use of pre-project introduction interviews where the team merely interviewed the micro-entrepreneurs enquiring about their vision for their business and their openness to explore new opportunities without any mention of equipment. All the micro-entrepreneurs who received the offer to participate in the cinema-in-a-backpack project declared, voluntarily, in the pre-interview that they are looking for ways in which to grow their enterprises through technology-based offerings.

Furthermore, in an attempt to ensure consistent participation in the various data collection activities required of participants (self-completion of questionnaires, participation in interviews) a 'competition' was launched which is meant to stimulate consistent effort, innovation and excellence to be documented and rewarded with additional equipment as prizes. This could potentially act as an incentive that would alter natural behaviour.

Even though both the cinema-in-a-backpack kit as well as the use of competitions to motivate engagements presents ethical concerns, one also has to consider the sustainability of the micro-entrepreneurs' enterprises. If the equipment was taken back after the experiment and if micro-entrepreneurs did not fully utilize the opportunity to learn and perform then this experiment could negatively influence their current business concerns. Not one of the micro-entrepreneurs participating in this project has the financial ability to purchase this equipment after the experiment in order to continue their cinema business.

Furthermore, entrepreneurs were also trained not only in the technology to be used for the experiment but also in the principles of performing such a business utilizing the technology. This training is also something that the entrepreneurs can use in all their different lines of business with good effect. The entrepreneurs considered this training as a value added incentive to participate in the experimentation project.

Participants in MOSAIC 2B are well aware of their options in terms of participation in the project and this has been clear from the outset of the experiment. The exit procedure involves a telephonic or email notification to the dedicated project coordinator. The project coordinator would then set up and conduct an exit interview. The participant who

decides to leave the experiment will also hand back the equipment to the project coordinator. To qualify to retain the equipment, participants must participate for the full project duration.

The exit interview takes the form of an open interview allowing leaving participants to share experiences and opinions freely. It includes the following qualitative questions:

- What are the reasons that you decided to terminate this project? Of these, which is the primary reason?
- What changes would need to be made in the project to convince you to come back? What kind of extra help would you have liked?
- Describe your experience with the cinema-in-a-backpack project. What was positive/negative about your experience?
- With regards to profitability at the end of this project, did you make profit or lose money?
- What was the most difficult part of this project for you?
- What lessons did you learn from this project?
- Additional comments?

Furthermore it concludes with confirmation that the experiment may use the participant's data collected up to that point in the final analysis and reportage.

### **3.2 The Consent Process**

Consent from participants was obtained first and foremost through the SLA. It has been shared for consideration and review at the first contact workshop with participants. This agreement stipulates the expectations of full participation and also the data requirements and assures anonymity of information.

As the research processes commenced and baseline data was collected it became again necessary to reassure participants through the project coordinator, and in one instance from a senior manager, that data would be anonymised and that responses would, at all times, be untraceable back to the individual. It was also necessary to ensure that informed and written consent was received from all participants regarding use of photographs and video recordings collected in which they appeared as part of the project's documentation and data gathering processes.

### **3.3 Privacy**

Participants felt particularly sensitive around certain categories of data collected as part of the baseline surveys, particularly related to household income and livelihood. Personal assurances were given to concerned participants from the interviewer, field coordinator and where required, management that data would be held securely, and when

captured it would be coded and anonymised to protect the identity of individual contributors. To underline the personal assurances given, all micro-entrepreneurs have access to a copy of the final report to verify that their identities, with relation to personal information, have indeed been protected.

To implement the decisions with regard to micro-entrepreneur privacy, all of the micro-entrepreneurs have been assigned with a random number. Thus, the MOSAIC 2B participants are referred to by an identification number, so that their names do not need to be saved in the system. In this regard, the DTN architecture [15] allows anonymity as users can identify themselves by an Endpoint ID (EID) syntactically expressed as a Uniform Resource Identifier (URI). Using URIs, significant flexibility is attained in the structuring of EIDs. They might, for example, be constructed on DNS names, or might look like “expressions of interest”. As names, EIDs are not required to be related to routing or topological organizations. In some environments, such a flexible naming may be advantageous. In the light of the nature of delay-tolerant networks, some form of authentication and access control to the network itself is provided. Users need credentials to be able to access the network. Besides, the DTN network protocol allows encryption of data.

During the design of the software components, care has also been taken to separate data of the participant’s activity from transactional and statistical data. Data stored in the MCU server and the MPP are assigned with unique identifiers, which is used to link personal data, ordering data, event data, and statistical analytics data. Research data transported from the tablets to the MCU are tagged with identifiers that can only be resolved in a configuration server. The analytics server does not contain any personal information, but merely identifiers that segregate data for analysis purposes.

The visual analytics software component running on the MPP has been designed considering privacy and confidentiality issues of the micro-entrepreneurs’ activity. It provides visualized analysis for each single micro-entrepreneur, which help monitoring only his/her own business activity, e.g. number of screening events, ticket prices, expenses, etc. Besides his/her own activity, a micro-entrepreneur can access global aggregated analytics without violating the privacy of all of the other participants. For example, micro-entrepreneurs can check what are the most requested movies analyzing his/her business activity or all the entrepreneurial activities as a whole.

Activity information, from each single entrepreneur and as a whole, can be accessed by the researchers to analyze the micro-entrepreneurs’ activity and the performance of the system components. During the training session, which took place before the kick-off of the experiment, all of the micro-entrepreneurs have been clearly informed how the

entire MOSAIC 2B system works and the possibility of monitoring their business activity. A consent form has been signed from all the parties, researchers and participants.

### 3.4 The “No Harm” Principle

To minimize harm in a project such as this, participants must be informed and aware and expectations must be managed with care. The nature of the experiment, as a pilot, does mean that sustainability after its conclusion was paramount in its design. Critically, this has been communicated to participants who do understand that beyond the 6 month experiment there is no guarantee of further engagement; fundamentally, after 6 months the licenses to legally operate mobile cinemas will lapse and the DTN will no longer be functional making it impossible to access legal digital content. To mitigate this risk the project team is engaging with licensing officials in South Africa to negotiate ongoing licensing as well as with content providers who may want to deal directly with the micro-entrepreneurs in future. This is however unclear and has therefore not been communicated to the micro-entrepreneurs as it may create an expectation that the project may not be able to deliver on.

Furthermore, it was agreed that a sustainability workshop with the micro-entrepreneurs will take place to conclude the experiment. At this point in time the team will be fully aware of the potential sustainability of the project and detail will be discussed. Referring back to the competition mentioned earlier in this article, using equipment such as video cameras as prizes provide complementary technology to the winning micro-entrepreneurs and they may use the cinema-in-a-backpack to show home made movies or to screen, for example, recordings of weddings to prospecting customers.

## 4. RELATED WORK

While codes of ethics and professional conduct have been established [11-14], they are oriented more towards professional practitioners than researchers in the field. Previous studies have raised methodological concerns about ethics and privacy in networked systems [3-4]. In particular, Wright et al. [5] examine privacy-preserving protocols in DTN networks. El-Eman [6] also raises questions regarding the reduction of harm and confidentiality issues in the context of open source software projects. For example, version control systems used in open source software projects allow the identification of the developers responsible for each piece of code, causing possible professional or personal harm. In this regard, Vinson et al. [7] argue that eliminating personal identifiers from the reported data in order to maintain confidentiality reduces the need for informed consent, but does not necessarily eliminate it.

Another ethical issue involves the recruitment of participants who may be coerced into volunteering, e.g. the

recruitment of students or employees as research subjects. Students may be inadvertently coerced into volunteering as research subjects by offering course credit for research-centered classes or extra credit for a research assignment. Storey et.al. [8], raise several ethical issues in addition to this covert inducement. Similarly, employees can also be subject to psychological, social and economic harm when research is conducted in the workplace [9]. In [10], Singer and Vinson identify several other ethical problems with workplace research.

## 5. CONCLUSION

The MOSAIC 2B project implements a low-cost network system to deliver multimedia content in rural South-Africa. For this purpose, innovative mobile technologies to empower micro-entrepreneurship in such areas have been employed. We present our work in an ongoing project that provides communities in rural South Africa with cinema experience by training micro-entrepreneurs in the operation of a DTN-enabled micro-enterprise. We introduce the target use case scenario, and discuss some ethical challenges and how they have been addressed. Particularly, ethical issues related to the involvement of the micro-entrepreneurs in such an experiment are considered. The field experiment highlights several real and potential ethical risks that the team had to deal with. Due to the vulnerable nature of poor rural communities additional care had to be taken while acknowledging the nature of experiments and its risks.

Throughout the experiment the team has made a concerted effort to identify ethical risks, devised ways to mitigate risks and also to communicate risks to all participants to allow the micro-entrepreneurs the freedom to make decisions relating to their continued participation in the project. Aspects such as voluntary participation, consent process, privacy, anonymity, confidentiality and the “no harm” principle have been considered. Such ethical issues are a major concern in research projects and must be considered in any experiment in such settings.

## 6. ACKNOWLEDGMENTS

The MOSAIC-2B project is partially funded by the EU FP7 framework program for research for research, technological development and demonstration under grant agreement no.611796, as well as from the Department of Science and Technology South Africa under financial assistance agreement DST/CON 0227-0229/2013. We thank the PUTCO transport corporation in Pretoria (South Africa) for its support in this project. We also thank the Disney Lab Artists, Maurizio Nitti and Alessia Marra, for providing artworks.

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