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*Connecting people across complex  
social divisions through ICT in a  
hyperlocal context.*

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# *Abstract*

*This thesis explores how the communication between stakeholders with complex social difference can be facilitated through Information and Communication technology, in a hyperlocal context divided by complex social structures. Further it scratches the surface of how the usage of minority world design methods such as participatory design, can be implemented in a majority world context.*

In collaboration with Cape Peninsula University of Technology in Cape Town, we participated in a project with a local waste management company. In a context where a part of the marginalized community work as informal contractors and made their living by collecting recyclables, issues with local security forces arose because their work were not being recognized by the outside community. We are trying to intervene in this social system with a participatory design approach. The context that we will work with is structured by complex social divisions that are deeply rooted in history. As interaction designers we want to see how technology and use of technology can help improve the relationships amongst the social divisions in a way that profits involved stakeholders.

**Keywords:** Interaction design, participatory design, recycling, hyperlocal, postcolonial computing, network, complex social divisions.

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# 1 Introduction

## *1.1 Origin of the project*

In December of 2013 we received an invite from our institute (K3, Malmö University) to collaborate in a project between Malmö University and Cape Peninsula University of Technology (CPUT) of Cape Town, South Africa. The project was planned to last for about 6 months, and would include two phases. The first phase included a 3 month project in Malmö, Sweden, where students and lecturers would come from CPUT. The second phase would be in Cape Town, South Africa where students and lecturers would come from Malmö University. The initial idea of the collaboration was to see how city space can be used to support interaction between people and businesses through digital means.

### *Arrival to Cape Town*

We arrived in Cape Town on the 4th of February 2014 where we met the students who had spent the time in Sweden, one of our professors from Malmö University who is also a professor at CPUT, and an employee of Cape Town Partnership (CTP) who had been brought on to the project as a local-context expert. During our initial discussions we found out more about what had happened in Sweden, and more about what changes and additions that had happened in Cape Town. In Sweden a concept idea had arose to explore what a mesh network could be used for in a city to facilitate communication between businesses and people. It would basically mean to set up a hyperlocal, place specific (Messeter, 2009, p. 5) digital network around a specified geographic area, such as a street or a district of a city.

### *Mission*

In Cape Town, connections had been made with an newly established local recycling organization (LRO) that were very interested in seeing what a mesh network could do to improve their business. The LRO had been running since January 2014 and they describe themselves as a business that cleans up the environment and creates opportunities through recycling. The opportunities are created by opening up their business for informal trash collectors to collect recyclables and in exchange for cash or coupons that contain more value than cash, because you can buy subsidized goods for them.

### *Project setup*

The project was at this point being facilitated through the Cape Town based design company DOO.co-lab and Cape Town Partnership (CTP). With them in the project we were able to use and find resources that we would need to do our project. One of our shared interest with them was to explore how participatory design (PD) methods could be used in a socially complex context that contains users who are not typical to where PD primarily has been used, as Puri et al. (2004) also conclude.

## *1.2 Authors*

We have performed the majority of the work in such close collaboration so that the division between the one and the others work effort is close to impossible to separate. Therefore we will frequently use terms as “We” and “Us” when describing our process.

## *1.3 Definition of terms*

*Following acronyms will be used frequently:*

- *SDR*; Service DiningRoom
- *LRO*; The Local Recycling Organization
- *CPUT*; Cape Peninsula University of Technology
- *CTP*; Cape Town Partnership
- *ICT*; Information & Communication Technology
- *D6*; District 6

# **2 Background**

The project started with us getting an extensive tour of the East City and Cape Town in which the project would take place. Guided walks were conducted with local experts from CPUT and CTP, and we visited places such as the District 6 museum which holds culturally and historically significant information. All of these were foundational in building up a contact between us and the people who reside in the context. We then started formulating a problem after identifying several key stakeholders who we had seen issues amongst. Technology would be central, but in the background of

this solution. Instead it would be the people and places in the area who would be the primary solution to the concern of communication across the complex social divisions.

*Research question:*

*How can ICT be used to facilitate communication between waste producers and informal collectors in an urban environment that is structured by complex social divisions?*

## *2.1 Context*

Within the larger area of D6, we have focused our efforts to an area we refer to as the hyperlocal context. This is the area in which we conducted our studies and where our concept iterations would be conducted. In understanding this, we will be able to do a project that fits into the existing context. We think that this understanding is essential to make a good, sustainable design.

### *2.1.1 Cape Town*

*“Cape Town is still a city in the making. The question is, whose tastes, smells, feelings, sights and sounds will come to prevail in defining the character and experience of the city? Is our city merely a playground of the rich, with the poor experiencing what the city has to offer – even Table Mountain – merely as a backdrop to their daily struggles for survival?” - Van Graan (2008, p. 5)*

Today parts of South Africa and Cape Town are in blossom. Its scenery impress tourists from all over the world that appreciate its indigenous nature and multicultural society. As a society that is just two decades past a social structure so radically different than it is today, it has come a long way, but it is still suffering deeply by the ripples of the old days. We can see an attempt to give equal opportunities through the affirmative action system (reservation/quota) to colored people in occupations where the majority of people are white, which both have positive and negative consequences, also discussed in the article “Quota systems in Africa” by Kethusegile-Jun (2003, pp. 1-7). But there is an even larger economical gap created, between middle class and low income areas (City of Cape Town, 2010, p. 20). It seems that the City of Cape Town have a tendency to spend its resources on makeup and

cover for the scars, instead of focusing on bridging the economic and social gap. This is an empirical discovery, grounded in retrospective with articles like “The government of Cape Town Violates the Rights of the Poor” by Ludwig (2011). We will not discuss or try to explain apartheid further in this paper, but we want to acknowledge the enormous social differences that still taunt this beautiful setting.

### *2.1.2 District 6*

We spent most of our time in an area in the East City of Cape Town called District 6. District 6 is an area inhabited by an ethnically and culturally diverse society. The majority consist of colored Muslims, called Cape Malays and native black Xhosa speakers, but also Afrikaans speaking whites and even a small number of Indian people (City of Cape Town, 2010, p. 9). During apartheid almost all of its inhabitants were forcefully relocated into the townships at the outskirts of the city. Nearly all of the infrastructure were bulldozed to the ground, leaving only a few churches and mosques standing (Field, 2008, p. 23). The government renamed the area to Zonnebloem and built only a couple of buildings on a small portion of the leveled area, one of them is the Technikon that is now called Cape Peninsula University of Technology.

#### *Moravian chapel*

During our stay in Cape Town we stayed at a flat in one of the only buildings that survived the destruction that occurred during apartheid. The building is a white church named Moravian Chapel. This was not only a beautiful building, but with it we went a small step further in understanding of what the inhabitants of former District 6 went through. Because of many people still gathering in the church main hall, we had encounters that got us to realize some of the strength of the people returning. People told us stories of how they used to go to a school right next to the church but is now no longer standing, and how they used to play and were able to go anywhere without being afraid.

Now they are taking back what is rightfully theirs (Beyers, 2008, p. 18). Even though many still lived in poverty and exercising different religions they still managed to cooperate. Colored, black and some of the white people are

helping each other and embracing Ubuntu, which is a philosophy that says “*I am what I am because of who we all are*”. Simply said, it means; Help your neighbor.



*Fig 1. Above: Geographic overview of the hyperlocal context. Part of District 6 & the East City, Cape Town, South Africa.*

### **2.1.3 The premises of the LRO**

#### *Main depot*

The main depot is where the LRO have their office and keep the container where all the recyclables are accumulated before they sell it off. The premise is situated in the East City of Cape Town which is quite central. It is also an

unusual location for a trash buyback company. There are several other buyback companies in Cape Town, but none of them are as centrally situated as this one. This is where collectors can come to get paid for the recyclable trash that they have collected.

#### *Issues around the main depot*

The location and the type of business that they are conducting have caused disturbance amongst nearby businesses. The nearby businesses that are expressing this are mainly restaurants and cafés. They say that the homeless people that are walking past their business are causing a disturbance to their businesses by standing outside and sorting their trash and sometimes communicating to each other in a way that makes the average café consumer feel uncomfortable. There have been serious implications for the LRO as they are now under threat of being thrown out of their main premise. We have learned that the building owner of the most “disturbed” café and the building owner of the premise that the LRO is renting have close contact. This means that the threat is real and possible, and could unfortunately destroy the whole business idea of the LRO completely.

#### *Satellite station*

To battle this issue the LRO has opened a smaller satellite station just 3 streets away. This has erased a few problems regarding complaints of surrounding businesses. The location of the satellite station is more strategically placed. It is located in an area that has a lot of circulation of street people. It neighbors the Service Dining Room and across the street is a large parking lot where some homeless people sleep during the night.

The satellite station is constructed inside an old garage which opens up and serves as the whole premise during business hours. From the garage door hangs a digital scale that is used to weigh trash that is brought in the entrance of the room there is a table where the operator of the station sits and takes care of business. The back of the room is used as storage of the trash that is brought in during the day. The room is being emptied of trash which is being brought to the main depot 2 times a day, once at lunch time and once at the end of the day.



*Fig 2. Above: LRO Satellite station and The Service Dining Room*

#### *2.1.4 The area surrounding the premises of the LRO*

During the first month of our time in Cape Town, we spent a lot of our time in the area surrounding the LRO together with different people. We heard personal stories, saw intense encounters with, to us, completely unexpected outcomes. This helped reconstruct our view of how people can work, a view that was previously full of assumptions. This type of pretext to our work enabled us to be more flexible and open to changes in our design work.

As stated in section 2.2.1, the main depot of the LRO is situated up the street from modern cafés and restaurants, which makes the main depot less viable as the one and only premise for the LRO. This is why we spent most of our time at the satellite station while doing our research. The satellite station is also where a lot of encounters that were new and interesting to us occur, as it is located in a more socially diverse area and is also an area where the homeless people of the city is more established.

#### *History of the area*

Many of the people who are homeless in this area once lived in the area when it was full of housing. Most of today's homeless people of the area got

forcibly removed from there by the apartheid government to the Cape flats where they had to go through emotional and physical abuse (Blake, 2014). The housing that was there was all destroyed by the same government and is now replaced with businesses and parking lots. One of our closest friend who is a street person always talks about how he used to play there as a kid, and showed us some of the foundation of the houses that are still seen in the ground of the parking lot. He is now an informal parking guard, a job he created for himself to be able to sustain himself.

#### *Businesses in the area today*

The businesses in the area range from design and architecture firms, carpet factories to clubs and bars. All of them have different stakes in the area and some are more and some are less active in the ongoing process of including the marginalized people in the area.

## *2.2 The problem*

We have identified a few key stakeholders in the context which we consider important. They are important because of their place in the city and how they affect each other. The interrelationships of the stakeholders are something that we have had to study closely to be able to understand the context.

### *2.2.1 Stakeholders*

#### *The local recycling organization*

The LRO describe themselves as follows: “We are a business that cleans up the environment and creates income opportunities through recycling. We make it easy for you to recycle and work with the small guys to provide our services because we believe that the opportunities should go to those who really need it”. The business is located in the East City of Cape town. It is only operating in a 2.5 km radius of their main depot. One of their primary goals is social community development as Cape Town is plagued with homelessness and drug abuse (City of Cape Town, 2007). The informal collectors that are working with them are often categorized as this, and are also very economically vulnerable. The LRO and their operation has been our main case study for the project

### *Interests of the LRO*

Their main interest this project was to see how we could use a mesh network to improve their business. One of the main ideas that they expressed is, “how can waste producers let the collectors know that they have trash?”. We did meet with the main drivers of the organization on a couple of occasions throughout the concept development period, and have had the opportunity to discuss their organization and issues that they are currently facing.

### *Waste Collectors*

The collectors are as of today a group of ~30 people. They are all registered at LRO and are known to the persons who operates the business operations. If you look from a general point of view, a collector is seen as a person who is marginalized in the society. Situations such as homelessness, drug abuse and unemployment are what we currently can see as common denominators amongst the collectors.

Keep in mind, this are our terms for describing them, not a street person describing himself. We want to signify that when we call someone a street person or a homeless person, it is a label that we give to them. It has almost nothing to do with who they are, what they do, how they speak or how they look. We use it solely to very superficially describe a group of people that are marginalized in the area.



*Clockwise from top: Fig 3. Group of Collectors at the Satellite station. Fig 4. Collectors transporting materials. Fig 5. Collectors waiting for weigh in at Satellite Station.*

### *Waste Producers*

Waste producers are local businesses in Cape Town that are situated in a 2.5 km radius of the LRO's main depot. The LRO actively search for businesses to collaborate with. If a business gets interested in the service that the LRO provides, they contact them and then the LRO ask a collector to go and pick up the waste at a certain time.

### *Security forces*

The city of Cape Town has hired a private enterprise which act as safety guards of streets around Cape Town. The safety guards who works for the private enterprise has the power to arrest people under a by-law that is constituted in Cape Town (City of Cape Town, 2007). This by-law makes it possible for them to arrest people for loitering, which is a very loose term and been used to intentionally or unintentionally further injustice. At several occasions we have seen interventions from local security forces when collectors are searching for recyclables.



*Above: Fig 6. CCID guard complaining about nuisance outside the Satellite station.*

### *Surrounding activities & indirect stakeholders*

According to our contact persons at the LRO, there are restaurants and other companies in the area who are affected by the recycling organization and need to be considered stakeholders. We have observed several people complaining about the waste collectors behavior and presence. They argue that they are scaring away customers and make a mess whilst collecting. We attended several meetings with different businesses in a quest of trying to understand their main problems with the collectors.

Close to the satellite station of the LRO, there is a relatively large liquor store that sell cheap alcohol. It is also next door to the Service Dining Room, which is a place that offers a hot meal for 5 cents. If one of them disappears or relocate, the area might lose interest from street people. This makes the SDR indirectstakeholders for the LRO.



*Above: Fig 6. Meeting with local businesses about development in the area.*

### *2.2.2 Complex social divisions between stakeholders*

As we built our initial understanding of the social structure of the area, through field research and interviews with people, we have found that the relationship between the three main stakeholders (the LRO, collectors and local waste producers) are complex. The social, income and class related differences makes it hard to build relationships between the involved.

#### *Businesses and Collector relationship*

Many of the businesses do not want to have anything to do with street people and collectors. When street people hang around their premises, they complain to local security forces. The security forces then has to drive the street people away as they are funded by the same private businesses.

### *LRO and Collector relationship*

The businesses in the area that like the idea of LRO sometimes choose them to handle their trash. Their main interest in the LRO is their ability to then be able to brand themselves as environmentally and socially sustainable as businesses. Another interest, is keeping homeless people and alcoholics off the streets of their premises. Their issue is that these street people make their businesses look bad from an outside perspective. This brings in the fourth stakeholder in the project, which are the security forces.

### *How the relationships intertwine*

Today, collectors work as informal contractors for the LRO. The businesses then chose to hire the LRO as their handler of trash. The tension that arise between the different stakeholders is something that we must take into consideration. We feel that there is a need to formalize the positions of the collectors. We hope that this can help develop a better understanding for the security forces and the public of what the collectors and the LRO is trying to achieve (Blake, 2014).

### *2.2.3 Technology: Mesh network*

The idea of setting up a mesh network came up in Malmö during the “Line Project”. “The Line” is the first phase of the project that was carried through in Sweden. The purpose of the idea was to explore what possibilities a network with a designated geographic boundary could provide to the people who use that space. It was not meant to be a solution to an existing problem. The exploration of that then became one of the base starting points of this study.

### *Implementation of Mesh network*

The realization of using the mesh network in this project failed due to technical difficulties and high cost (Holmberg, 2014). The failure did not affected our work as we were still thinking about concepts to use for hyperlocal networks. The only difference it made is that we chose to use existing local networks instead.

## *2.3 Problem statement*

One of the main user groups in the project is marginalized in their city because of the complex social divisions that exist there. We wanted to see if, and how we can engage this group of marginalized people and get information that is valuable to the development of the area, and support their needs. We wanted to bring this group, which is also key to the LRO ecosystem into a position where they are also in a position to impact the further decisions of how things should operate.

We explored how one can interact with socially different groups within a geographically constrained digital network. We know that these different groups have big differences when it comes to availability of technology and experience of using technology, and that is something that we took into consideration as well.

We focused on using participatory design methods in an urban environment that is specific to the East City and District 6 of Cape Town. Further we will investigate how the usage of ICT can facilitate communication between actors of different social profiles in this hyperlocal network.

*Research question:*

*How can ICT be used to facilitate communication between waste producers and informal collectors in an urban environment that is structured by complex social divisions?*

## **3 Theory & methodology**

We chose to use theories and methodologies that would help us to get a broad understanding of a, to us, foreign context. We also chose to use methodologies that aims to include the people that we design for in the process. It is our firm belief that stakeholders possess the knowledge of changing their own situation. Designers can offer different ways of conducting design, but the knowledge and design ideas needs to arrive from within the context. Because of the highly empirical nature of our research we chose to use an iterative design process, because of its ability to be susceptible to changes in a constantly fluctuating context (Dow et al, 2010. p.

3). To be able to make sense of the context after the initial research we used the systems thinking of Leverage Points to be able to map out the different parts.

### *3.1 Participatory design*

*"[PD...] is the belief that all people have something to offer to the design process [...]" - Sanders (2002, p. 1)*

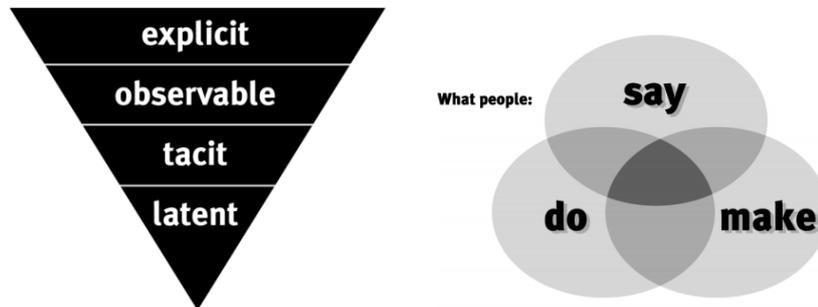
Participatory design is a methodology that spans over several fields, from architectural planning to software and graphic design. A practitioner of participatory design tries to involve each stakeholder in the design process (Sanders 2002, p. 3) and thereby creates environments that can be appropriate and responsive to the users' different needs. It is not only the efficiency and economical values that plays a role when designing, but also the emotional, spiritual and cultural aspects of the future users. Participatory design is also a common approach to place-making, with its intention of creating both formal and informal places that promote people's health, happiness, and wellbeing.

#### *Brief history*

The inclusion of central stakeholders in the decision-making of design processes has a relatively short history compared to the traditional ways of conducting design. In the middle of the 1900s there was a growing demand of incorporating participation in city planning that ignited a few thoughts of conducting city planning with the help of citizens (Nichols, 2009). But it was not until the early 1970s, Scandinavia, within a work union regarding system design that researchers of the "Collective Resource Approach" started to generate different techniques and approaches that could help workers influence the structure and design of their computer applications (Bødker, 1996, pp. 215-217). The methodology gained momentum in the late 90s and the beginning of the 2000s, especially in information and communication technology (ICT) and human computer interaction (HCI) where usability is considered an important part of the system. Further the user involvement in the design of an application or a service became crucial when the number of people using an application rose, and business understood the value of involving users in the design process. In one way it became a selling point, people could at this point soon pick and choose within a sea of applications with the same features.

### 3.1.1 Sanders say, do make -model

*“When all three perspectives (what people do, what they say, and what they make) are explored simultaneously, one can more readily understand and establish empathy with the people who use products and information systems“ - Sanders (2002, p. 4)*



*From left. Fig 7. Sanders triangle of how we can learn from people. Fig 8. Sanders “Say, do, make” model - Sanders (2002, p. 3)*

With different methods of PD the designer provides a platform for various stakeholders to get involved in the design process. Involving stakeholders in the design process can provide what Sanders (2002, p. 5) and Polanyi (1983, p. 2) refer to as tacit knowledge, “how people feel”. Sanders argues that it is first when combining what people say, do and make we can begin to understand the true needs of the user. Tacit experience provides more than information than can be spoken or expressed through writing, it gives the designer a real sense of empathy for the situation of the involved stakeholders. Because of being in the process together with the stakeholders, the designer needs to be most alert. It is also crucial that the designer possess a certain level of general knowledge in several fields for example, social studies and anthropology (Smith, 2011). Due to the fact that some of the information gathered when using these kinds of methods happens ‘in the moment’, participants do not always perceive that they find a significant piece of the puzzle. Participatory thinking is often seen as an effective state of mind to be in when designing where it is hard to capture users, achieving acceptance over the new design and when the context is changing rapidly (Honest & Hodne Titlestad, 2008).

*“Participatory design is generally regarded as an effective approach in systems development to overcome challenges such as changing contexts, difficulties of capturing users’ needs and problems of achieving systems’ acceptance. However, user participation is associated with certain contextual assumptions or beliefs from its origin in the West that are not always applicable in the context of Low Income Countries” - Honest & Titlestad (2008, p. 1)*

### *3.1.2 Participatory design in a majority world context*

Roughly speaking, the minority world is comprised of those social groups and socio-political ecologies where global power and resources are concentrated in the hands of an over-consuming minority. These ecologies are typically found in some Western-European and American countries, but are scattered across the planet. Majority world contexts are ecologies in which the majority of people of on the planet operate. These majority world contexts are characterized by there being not enough resources (water, building materials, sanitation, etc.). One of the things we have learnt on this project is that majority world contexts and minority world contexts have very complex relationships to each other. In the geographical area that demarcates Cape Town, there are both minority and majority world ecologies. The LRO ecology incorporates both of these into its business model. Normally the minority world exploit the majority world. The LRO is trying to work in such a way that it benefits members of both worlds. By having begun to see these complex relations between the two worlds, we now also realize that Malmö also consists of a complex mix of minority and majority worlds. A feature of the relation between majority and minority worlds is that there are complex social divides which separate them from each other. These are the result of histories of slavery, colonialism and – in South Africa – apartheid. Participatory design methods has primarily been tested in western settings, which is a minority part of the world (Pearson Education). There, companies are often structured with a clear and formal hierarchy (Kensing & Blomberg, 2008, p. 167). In the majority world, in low income areas where the society is structured by complicated social divisions and structures, with people who does not have the same experience with technology as many high income countries have, the methods of PD has not been widely explored (Offenhuber

& Lee, 2008; Merritt & Stolterman, 2012; Oyugi & Nocera, 2008; Puri & Byrne, 2004 ; Winschiers, 2006)

PD has been interesting to us because of the ways in which PD makes use of social sciences and anthropological methods and approaches, due to enormous differences in social perspective and behavior in ourselves and other stakeholders in the project. Agreeing with Offenhuber & Lee (2012) and our local resource manager from CTP and looking at the context we have been performing our research, it is extra valuable and important with so called tacit knowledge. We could not rely on explicit and implicit knowledge to perform our design, due to the differences in social interaction.

There are many barriers and unique issues when working with PD in the layer that exists between the majority and the minority worlds, we are agreeing with the bullet list produced and published in “*The challenges for participatory design in the developing world*” - (Oyugi, Dunkley & Dray, 2008)

- *Power distance*: The perceived status between the host communities and the designer.
- *Cultural/language barriers(including body language)*
- *Incompatibilities of PD techniques* with host community values and communication codes.
- *Low literacy levels*: the host communities may have low literacy level thus hindering collaborative activities between them and the designer
- *Poor telecommunications infrastructure*

In our specific context a big problem has been an issue not captured in the above list; the lack of interest in participation due to intoxication and drug abuse. This was an important factor forcing us to invent appropriate methods for accessing collectors’ triangle of experience of “What people say, do and make” (Sanders, 2002, p. 2). See fig. 3 under section 3.1.1. Our human proxy became the result of this (see section 4.4).

### *3.1.3 Vulnerable stakeholders*

There are cases, where a group of designers have tried to design in an, for them, foreign and different social context. One of the more prominent in the field of interaction design is the research of Brandt et al. (2010) and their work on what they refer to as situated elderliness. Where the “[...]overall objective is to develop and explore welfare technologies and service models that support experiences and social interaction”- Brandt et al. (2010, p. 400). One part of their discovery is that the elderly community have a totally different way of seeing themselves, where one thing is; that they do not refer or want to stigmatize themselves with biological age. Instead they use terms like “the others” and refer to different relations when they describe themselves and their community. Brandt et al discovered that the elderly community were structured in different social structures and divisions, in one way separated from the society as they saw it.

Their conclusion after failing recruiting to different workshops because of the elderly did not see themselves as users of technology, they realized that they needed another approach. They decided to participate in elderly everyday practice and with that as a starting point, beginning to understand what the elderly really could use, and on their terms. This is how we choose to tackle Participatory thinking in our research. With the realization once again; we cannot design something we think they need.

### *3.1.4 Postcolonial computing*

As a response to designers not being aware of the cultural significance that gets embedded in their projects, the postcolonial computing framework made an entry to interaction design research fields. Postcolonial computing is trying to raise questions for the designer about what happens when she travels to a foreign place, and brings with her the design methods and practices that she has learned, or taken for granted, to be universally true.

#### *Meaning of the term*

The postcolonial approach is not focused on the historical relationships between countries where the colonizing country would impose its cultural traditions on the colonized country. It is recognizing that even today, colonial connotations are present when one group of people characterizes another

group of people of being in need of enlightenment or development. These connotations can be hard to find, but are present all over the world.

*“Postcolonial theory has most powerfully demonstrated the ways projects we engage in for “others” often tell us more about ourselves. Postcolonial computing, then, is not a project of making better design for “other” cultures or places. It is a project of understanding how all design research and practice is culturally located and power laden, even if considered fairly general. This specificity is not a problem to be solved, but a reality that should be central to design practice – seeing the ways that design is culturally specific should allow us to broaden the conversation about what other practices can count as good design.” -Irani et al.(2010, p. 2)*

When used in projects, postcolonial computing is telling the designer more about herself than others when trying to engage others. With this point of view, we can learn to identify which parts of our design that are actually from ourselves and see how they are affecting the actual design.

It offers an alternate procedure to the design process than the familiar approach of identifying users to ideas and iteration. The suggested alternate formulation is trying to be more sensible in the evaluation of the design work. Engagement of users, articulation of their needs and its translations is the form that postcolonial computing offers.

#### *Description of formulation*

“Engagement” is described as connecting users to an application or work activity, in order to understand their way of doing particular work or activities. “Articulation” are how we as designers formalize the properties of the engagement and transform them into requirements for further design work. “Translation” is how the requirements that are found in “Engagement” are gradually transformed from statements about a domain to statements about technology and eventually into specific pieces of technology designed to support the application domain (Irani et al., 2010, p. 7).

#### *The goal of Postcolonial computing*

The main goal of postcolonial computing is to understand how power relations in design practice are enacted and how differently it is understood from the point of view of different persons. When thinking about the design

process in terms of a flexible engagement with different groups and taking into account the complexities of how perspectives are articulated, and the implications of attempting to translate these, one can start to create a starting point for a design that is embracing heterogeneity, rather than a design that is trying to avoid it and thereby eliminating it (Irani et al., 2010).

### *3.2 Iterative design*

Iterative design is a design methodology that is based on the repetitive cycling of a design process. That means repeating the act of prototyping, testing, analyzing, and refining a product or process.

Because of the highly empirical nature of our study, and the radical social complexities that shapes the context that we are in, we have chosen to develop our concept through an iterative design process. We think that the most advantageous attribute of this kind of design process is that it gives us the ability to get incremental and situated feedback (Dow et al., 2010, p. 2). It is also central in providing learning and motivation during design projects (Dow et al., 2010, p. 2), something that is essential to our way of understanding the problems that we face in this foreign environment.

Iterative prototyping has also proven to be very effective while designing under time constraints (Dow et al., 2009). We had put aside 1 month to develop our research tool that was meant to be used simultaneously and flawlessly at 3 different stakeholders at once. Therefore we chose to start with a very basic prototype, and then gathering feedback from the different stakeholders so that we could implement the needed functionalities for the next test.

### *3.3 Leverage points*

*“Folks who do systems analysis have a great belief in “leverage points.” These are places within a complex system (a corporation, an economy, a living body, a city, an ecosystem) where a small shift in one thing can produce big changes in everything. This idea is not unique to systems analysis—it’s embedded in legend. The silver bullet, the trim tab, the miracle cure, the secret passage, the magic password, the single hero or villain who turns the tide of history. The nearly effortless way to cut through or leap over*

*huge obstacles. We not only want to believe that there are leverage points, we want to know where they are and how to get our hands on them. Leverage points are points of power.” - Meadows (2009, p. 1)*

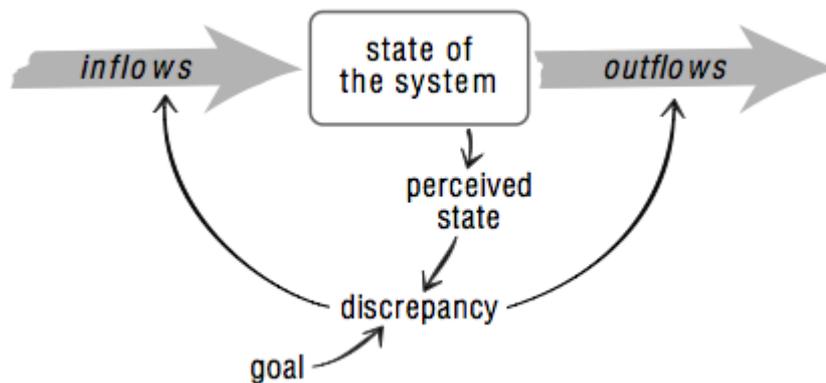
When we started discussing the system in which the recycling business operates we realized that the space that we are working in consists of many systems, some of which interact with each other in complex ways. The people and businesses involved range from very different social classes, have different cultural backgrounds, and understanding of what their place in the system is. Everyone and everything is a unique part of a complex system. We are the ones who must take responsibility in not making assumptions about anyone or anything, but try to understand and respect everyone and everything in order to make a good design that fits into the environment and that is profitable to everyone. To be able to break it down we looked at past studies in systems analysis. We did not want to blindly design something and force it into a system where we do not really know what is going on. Therefore we started to discuss and break down what we knew into smaller parts. We used Meadows' (2009) "Leverage Points: Places to intervene in a system" as a basis for our discussions. The reason for this being so that we could clearly visualize the different stakeholders in the systems, and see how their behavior affects other parts of the system. It was also for us to see where we would be able to do something without disturbing what may seem like unimportant parts, but actually are essential for the system to run. We also realized that we could not simply use our assumptions to analyze the system. Therefore we decided to do the analysis when we had a lot of fieldwork done. Meadows provides a list (fig. 14) which she describes as a work in progress, and not a sure-fire recipe to find leverage points. It should be used as an invitation to think more broadly about the ways to change a system.

- Places to Intervene in a System**  
(in increasing order of effectiveness)
12. Constants, parameters, numbers (such as subsidies, taxes, standards)
  11. The sizes of buffers and other stabilizing stocks, relative to their flows.
  10. The structure of material stocks and flows (such as transport networks, population age structures)
  9. The lengths of delays, relative to the rate of system change
  8. The strength of negative feedback loops, relative to the impacts they are trying to correct against
  7. The gain around driving positive feedback loops
  6. The structure of information flows (who does and does not have access to what kinds of information)
  5. The rules of the system (such as incentives, punishments, constraints)
  4. The power to add, change, evolve, or self-organize system structure
  3. The goals of the system
  2. The mindset or paradigm out of which the system—its goals, structure, rules, delays, parameters—arises
  1. The power to transcend paradigms

*Above. Fig 14. Places to intervene in a system (in increasing order of effectiveness), (Meadows, 2009, p. 3)*

To give an example, Meadows uses an analogy of a bathtub to describe a system. A bathtub contains water (the stock, state of the system) and has an inflowing faucet and an out-flowing drain. If the inflow rate is higher than the outflow, then the amount of water (the stock) will rise.

If you want to take a bath you have a desired water level in mind (your goal). You might plug the drain, turn the faucet, and let the water level rise until the water level reach your desired goal. You can say that you will fill the tub until the discrepancy (the difference) between your perception of the state, and your goal is zero. This is a simple system.



Above. Fig 15. Basic diagram of a system, (Meadows, 2009, p. 4)

To describe a more complex system we can take into account that you have two taps, one for hot water and one for cold water. Then you are also adjusting another system state, which is temperature. Suppose that the hot water inflow is connected to a boiler in your basement, so it takes time for your hot water to come through the tap in your bathroom (Meadows, 2009, p. 5). To reach your goal, there is now several components that you have to take into account, and that makes the system more complex.

## 4 Methods

One of the main issues that the researchers from CTP had faced in communicating with people across the social divide, is that many groups and people have already been there, and that the area is over-researched. This has led to a situation where many homeless people are not willing to participate in research studies. The main reason being is that they feel that they are being used, but not getting anything in return (Blake, 2014). This led us to rethink our way of using our PD methods from home, and generally change our approach to do research. After a discussion with one of the local students and

one of the researchers from CTP we concluded that we needed a way to communicate where our purpose of being in the field is not primarily research based, but that the communication should happen more as a casual encounter. It is also important to think about the way that we are speaking. Our main user group is not familiar with the language that we use to describe design, technology or other academic phrases (Oyugi et al., 2008, p. 1). Therefore it would be important to try to find keywords that they use, and that we also could use in our communications with them to better communicate clearly and avoid misunderstandings and expectations. This led us to the idea to work at one of the LRO's satellite depots, and through working there do our research. We would from there be able to have small chats with people who came there while doing regular work like, weighing the trash that came in, sorting recyclables, registering new collectors etc. This idea laid the fundamental part of integrating PD into our project and served as a method that we chose to call "Human Proxy".

## *4.1 Observations*

Conducting observations is a useful method of gathering information in all stages of design. In an early stage of the design process it may facilitate the understanding of the stakeholders' context, tasks and goals. In a later stage of the development it is often use to evaluate how well the product or service supports the set goal or task (Sharp, 2011, p. 247-248).

There are different degrees of participation when observing. It range from passive observation, where the designer try to not intervene, to participant observation, when the designer tries to become a full member of the group that is studied (Sharp, 2011, p. 251-252). Problems with the later can be that the designer does not possess the knowledge or skills to participate fully in the context. Or as in our research the language / cultural barrier as well as the perceived power distance between us and the collectors. Through interviews and surveys people may tell us what they think we want to hear, or might be unaware that they possess certain knowledge that could be valuable to the design process. As covered in section 3.1.3 Sanders argues that it is first when all the ways of gathering information is conducted simultaneously we may get a larger picture (Sanders, 2002, pp. 1-4).

The human proxy model (see section 4.4) is our way of trying to understand the context where we combine participant observation, interviews (see section 4.2), the prototype applications (see section 5.3) and the use of ourselves as a connection, a hub between waste producer, the LRO and the informal contractors.

## *4.2 Interviews*

There are different ways of conducting interviews, the main concept is simple; the need of questions and a suitable subject to ask them. We will not cover any deep theory regarding this, but we want to highlight that our take on Interviews have been “casual encounters”. After initially tryouts with asking marginalized people a set of questions and getting standardized answers such as “*we need shelters*” and “*The security people are a pain in the ass*”. It became obvious to us that we needed to reach the informal contractors through less formal way of conducting interviews, thereby the casual encounters as a part of the human proxy (see section 4.4).

## *4.3 Prototypes*

Prototypes serve as a visionary expression of a final product or service and is often seen as central to any design process. Prototypes can be built in varying levels of fidelity, which enables feedback on the level in which it is built. Feedback on low-fidelity prototypes can provide feedback on overall functionality and experience, whilst high-fidelity prototypes provide feedback on details such as visual elements (Saffer, 2012, p. 174).

We will use prototypes as research tools while using the human proxy, which will enable us to get situated feedback, i.e. it is relevant and contextualized to its immediate surroundings (Viterbo et al., 2011).

## 4.4 *Human Proxy*

### *Idea*

The human proxy is a method we developed as part of the bigger prototype we designed for our project. It is a way of gathering valuable knowledge in design contexts structured by complex social divisions.

The idea of the human proxy is simple: by placing ourselves in the middle of the information system and actively working as intermediaries between waste producers, the LRO and the collectors, we gained knowledge that would have been impossible to obtain with non-participatory methods of conducting research. In this context structured by complex racial, language and class-barriers and plagued with drug abuse we have not been able to approach the collectors in using classical methods of PD.

### *Similar work*

There has been a few tries of implementing PD in a similar context, for example we see Offenhuber (Offenhuber & Lee, 2008) who worked with similar structures in Sao Paulo, Brazil. None of these, in our understanding, have worked within a context where important stakeholders are under the influence of either alcohol, drugs or a mixture. With the understanding of the participatory part regarding the social, anthropological and ethnographic components needed to gain tacit knowledge. We still want to participate somehow in the system, so we can access other knowledge than the automated answers that every collector or homeless person were responding with when asked nearly about anything: “We want shelters, fix jobs for us, security guards are always taunting us” and so on (Blake, 2014).



*Top-left clockwise; Fig 10. Rufael giving instructions to Collectors. Fig 11. Love interacting with operator. Fig 12. Love helping to sort recyclables. Fig 13. Rufael helping to weigh recyclables.*

## **5 Design process**

After completing the initial fieldwork we generated a concept based on the results that we found. After generating the concept we looked at where we would be intervening in the larger system that includes the key stakeholders of the context. After concluding our place in the system, we built a first prototype of our concept. We then tested it and followed an iterative design process which resulted in making minor improvements to the prototype for each iteration.

### *5.1 Fieldwork results*

We spent the first month of our studies in Cape Town doing observational fieldwork. Our professor who teaches at both Malmö University and CPUT and our local resource manager from CTP had prepared a thorough plan so that we could go from having a good overview of how Cape Town looks, to

being able to narrow down our view to the East city and the surroundings of the LRO. We spent one of the first days going up scenic Rhodes Memorial, where we could see the whole city bowl and all the way to the Cape Flats. We exercised our geographic awareness by constantly locating ourselves on a map of Cape Town and identifying good landmarks. Slowly we began to gravitate more towards the East City, which is a region of the city bowl. At this point we began speaking to people of all social classes and ethnical backgrounds. People were receptive to us and told us long stories of how they live their lives. This changed our perception of the area and how people use the space in different ways. What one person see when they look at a street is that is a place to walk. Another might see it as a place for business. Some even see it as a place to sleep. To have all of those different perceptions in our pretext material before we started to do concept generation is something that helped us greatly in trying to consider everyone as stakeholders in our project.

We realized early that there were great differences between us, design students from a rich and stable country, and the people we wanted to collaborate with, mostly homeless alcoholics and drug abusers that come from a long history of abuse (Blake, 2014). We made some of our first contacts on the streets by doing this kind of fieldwork. After just a couple of times in the area, we started to get recognized by people and trust relations started to emerge. This facilitated our later work at the satellite station, as we got accepted easier while communicating with the people that move in the area. To our help making sense and understanding the area, we had two local experts from CTP that have a long history of doing this kind of fieldwork in Cape Town. They have experienced a lot of failed projects from people who come from the outside, and who fail to see how the social structure is really operating, and therefore make solutions that build around faulty assumptions. These assumptions are what make the design solution fail, and sometimes the solutions are even destructive to the area.

The assumptions are about how different people operate in their daily life, and how people from different social backgrounds interact with each other. One such assumption that we had on our arrival was that homeless people are lazy, and all they do is hang around, beg for money and drink alcohol. When we started doing our fieldwork, this assumption quickly dissolved. We noted

how most of the people we saw were always busy, taking opportunities all over town. We also learned that most of the alcoholism in the town is due to growing up with alcoholism in families who has battled with it for decades. Part of the reason for this can be traced to the dislocation of the ethnic black and colored people from the city to townships such as Langa, which was officially launched in 1927. The displacement occurred because of the racist government as a response to white people's fear of catching disease from black Africans (Field, 2008, p. 23). The dissolving of this assumption, amongst many other, led us to a better understanding of the system and would be essential to enabling us to do a real, good impact on the city.

*Initial results:*

- We found that almost none of the collectors used any technology at all regularly. Some of the issues leading up to this that we have observed are that technology often get stolen or sold as they are seen as very valuable on the street
- We have learned from the LRO that they had tried to give mobile phones to some of their most trustable collectors, but phones had disappeared/been stolen in just a couple of days. The explanations for this are varying in story and reliability.
- Many of the people that live on the street today have been brought up on the streets or in a low-income context and does not have the same relationship with technology as we do. We have been brought up using different interfaces for technology and have therefore learnt how to orientate in what most classical western interfaces are built. Therefore, we cannot make the assumption that whatever we produce that involve digital interfaces is something that is properly understood and used by them.

## 5.2 Concept

### *Goal of the concept*

To be able to facilitate communication across the intense social differences between the collectors and the businesses operating in the area we wanted to develop a way in which they would communicate more directly with each other. We thought that there needed to be something that bridges the gap, both by making the work that the collectors are doing more visible to the businesses and creating more opportunities for the collectors to be able to make a living for themselves.

### *How we aimed to achieve the goal*

We gave local businesses the opportunity to message the LRO when they have trash that needs to be collected, and then having one or more of the collectors of the LRO picking it up, and then getting paid for the service by the LRO.

### 5.2.1 Place of concept in the existing system

#### *Analyzing the local context in terms of Meadows' Leverage Points*

To be able to make sense of the system and the area that we were approaching we tried to map it out according to the list of “Places to intervene in a system” that is provided by Meadows (see section 3.3).

Below we are going to use the list to describe different parts of the complex system of the LRO, collectors and businesses in the area. We will also try to see where we are heading with our project study. At this point we were hypothesizing about where our project would be, therefore some things that are written here might not have made it to the final project.

#### *12. Constants, parameters, numbers.*

This could mean changing the prices of recyclables/kg or adding the number of collectors to the system. According to Meadows' framework, this is the Leverage Point that would make the least impact to change.

*11. The sizes of buffers and other stabilizing stocks, relative to their flows.*

This could mean the size of main depot and the amount of trash that can/needs to be accumulated.

*10. The structure of material stocks and flows.*

How collectors move around streets and businesses to get to the satellite station of the LRO. It would also include how the trash gets moved to the main depot from the satellite station.

*9. The length of delays, relative to the rate of system change.*

The time that pass between trash being collected by collectors and then moved to the LRO.

*8. The strength of negative feedback loops relative to the impacts they are trying to correct against*

*7. The gain around driving positive feedback loops*

Maybe it can be to provide further work opportunities when someone has brought trash and shows signs of taking responsibility.

*6. The structure of information flows.*

Here is a place where we try to intervene with our project. We want to allow the collectors to have access to information about where to collect trash. We also want to let businesses know who is handling their recyclables for them, and how the handling will take place.

*5. The rules of the system (such as incentives, punishments, constraints).*

This is another place where we try to make a change. We want to provide an incentive to collectors of the LRO. For example, if you take responsibility and don't get drunk, you will get access to more information about where to find opportunities, and in the future we might implement a personal device that lets businesses communicate directly with you (as a collector).

*4. The power to add, change, evolve, or self-organize system structure.*

This is where the surrounding businesses that complain might be. They have the power to destroy the LRO completely, by getting them kicked out from their main depot.

This is currently being fixed by only using the satellite station as drop off-depot (see section 2.1.3).

*3. The goals of the system*

One of the main goals of the LRO is to produce trust in the outside community and businesses. To make money, to give people opportunities to make a sustainable living, security, and produce acceptance of collectors by security forces.

*2. The mindset or paradigm out of which the system-its goals, structure, rules, delays, parameters-arises.*

This is the unstated mindset of everyone involved.

*1. The power to transcend paradigms.*

The power to be able to change the mindset mentioned above.

## *5.3 Prototypes*

### *First prototype*

We decided that we wanted to create two simple applications that could act as a communication interface between us, the LRO and the local businesses. One application for waste producers to install on their smartphones and one web service for the satellite station.

We discussed which parts that we needed to implement in the first stage. We didn't want to create a database or any complex structure because we needed to get the prototype up and running in a few days. We chose to work with an online based service called Thingspeak and use this as a hub and storage for our information. In this early stage, the application is built with the most basic features. On the portable/smartphone side (that is supposed to be handed to the waste producer), we have a simple form with 4 checkboxes, representing the 4 main recyclables the LRO are handling (PET, Cardboard,

white/mixed - paper). When a waste producer checks one or more of the boxes and afterwards press the "notify" button, a String with data will be pushed to Thingspeak that stores the values and shows the information in different graphs. The webpage then pulls data from the Thingspeak server each 15 seconds and updates the data table accordingly, visualizing the information in the simplest way. In this stage it shows a table with each recyclable represented in a column. If a waste producer have cardboard ready for pickup, the corresponding column on the web page will turn red and show the time of notification. During the development of the first prototype, we spend a relatively long period searching for local companies to evaluate with. We found that there were many companies that were not ready to participate because they thought it was too risky to let street people into their premises. On the other hand, the ones that we did find were very eager to be part of something that could contribute to a better state of the area. In the end, we were able to get 2 companies to test with. Both of the companies are situated within 500m of the satellite depot.

### *5.3.1 Iteration 1*

#### *Preparation*

The purpose of this in-house test was to evaluate if the prototype application was ready for a real/sharp situation at the waste management company satellite station. We wanted to see if there would be any issues with using the application in places that may have implications on the network connectivity, and to see if any bugs were caused by using the app in different ways e.g. sending a value and then closing the application improperly and then opening it again and sending a new value.

#### *Implementation and test*

In the first evaluation and test of the pilot application, Micah Donnoli (PG student, interaction design) and our own Rufael Negash went out for a walk in central Cape Town. With them, they carried a smartphone running the Android OS with the prototype application installed.

They tried to send data in different conditions and places, to see if there was any issues connected to bad reception and further if the data was sent correctly. From the office we monitored the Thingspeak channels and cross

checked any values with the web application to see if the corresponding data from the android app was received correctly. A few crucial points came up that we needed to handle before deploying it in a real test situation.

### *Results*

- Simply showing with text whether there were trash or not became confusing when several notifications were showing at the same time. The solution became to work more with color coding as a supplement to the text in the receiving part of the app. As psychology researcher W. Christ (1975) found, color coding is a very effective performance factor.
- When the phone did not have proper internet connectivity the information about the message would not be sent, and the app would crash. There was a lack of feedback of this to the user. We fixed this by notifying the user with Android's toast view if the message had gone through to Thingspeak or not.
- Rufael sent a notification regarding PET at 11:32 and white paper 11:40, instead the web app showed 9:32 and 9:40. Strangely enough the supposed right time zone was not the right one, but with the help of some classic trial and error we fixed this problem.
- A major problem in this test was that sometimes when sending notification about one sort of recyclables, a different one was visualized on the web app. At first we thought it might be Thingspeak because of the irregularity, but we found it to be a small error in the Android code that we had written.

### *5.3.2 Iteration 2*

This test was made in collaboration with a small architectural firm close by the satellite station.

#### *Preparation*

We set up a meeting with the company's receptionist whom we had been given as a contact person after conversations with the owner. She showed us the facility and it became clear that it wasn't a lot of waste produced for the moment, but still enough for a small test. Initially we agreed that they would cancel ordinary recycling pickup for a couple of weeks. After installing the

software on her Android based phone we showed her the interface and what would happen in our end if she sent a notification. Everything seemed to be clear and she had no questions. Further we provided her with a notebook, an inspiration derived from the use of cultural probes (Gaver et al., 1997), so that she could write down any thoughts coming up under the test period, regarding anything from the app to the upcoming encounters with the waste collectors. Because of the limited amount of waste they produced per week, we set up a date a week later so that we could test out the prototype. The agreement was that she sometime during the day would use the provided app.

### *Implementation and test*

We arrived around 8 at the LRO's satellite station on the morning of our first sharp test, to a few more events than expected. As it happen to be, our main contact person and investor in the LRO, had resigned due to certain differences with the owners. It had impact in our work because the operator of the satellite station at that time was his contact, so he followed with him in his resignation. The result was a, for us, new person to build a relationship with at the same time as performing our first field test. It turned out that the new operator was a more stable person. When we arrived he gave a different impression than the first two operators, reading a book and surfing the internet and did not seem to be on any drugs. This operator also seemed to have more authority than the previous ones and could handle situations with angry collectors much better. This is probably also because of his background. The collectors seemed to be able to relate to him more. We also got along well. After establishing a first contact with the new operator we opened up the web application on the satellite station's computer (that has a 3G internet connection) with no complications, to check if the architectural firm had used the Android application. They had, the column of the recyclable "white paper" was red and the time of notifying was just a few minutes before. We showed the operator the prototype of the website. He understood what it meant without any explanation. The next step now was to find a suitable collector, preferably recurring and not intoxicated. Even though it was Friday and "waste disposal day", there was no collector passing by in the first 20-30 minutes, whereupon a whole group arrived at the same time. We decided to ask two recurring collectors that often collaborated together. We described the way and told them the name and address of the company, they seemed to understand even if they did not know about that

specific company. Further we informed them about which recyclables they had and the name of the contact person. They showed a big interest and almost ran down the street, so far so good. But after 15-20 minutes we became worried, due to fact that it is a relatively short distance to the pickup. One of us went after to check and did not see the collectors. On the way back, the collector came pouring with sweat from the opposite direction. He had not found the place and he was not happy about it. His friend seemed to have lost interest after trying to engage several other street friends to help them find the place. Love went with him to the company, showed the door and explained to him that he should ring the doorbell and tell them that he was from the LRO. It worked well, until the time when our contact person at the business showed the collector the materials. The collector started to laugh, he took the bag and gave it to Love, said “You take it, it’s not worth it” and shook his head, still smiling. Apparently it was a too small amount for him to be interested. That came to be when we earned our first money recycling white paper in South Africa. We donated the 1.5 Rand we had earned to the LRO.

### *Results*

This test gave us an understanding and a tacit experience of working with the collector. It is clear that a human factor, some sort of human proxy is needed. Further we definitely need a better way than just telling the collector where to go. After our test was done we started to discuss different lo-fi prototypes and came up with an idea about having a piece of paper, that either could represent a tablet, or just be a receipt that the collector gets each new pickup, telling them where to go and with information about contact person. Due to widely spread illiteracy perhaps the simplest form of a map and a photograph of the building would help?

### *5.3.3 Iteration 3*

This test is made in collaboration with a large local leather producer. We had spoken with the owner of the company before, and he seemed very interested in our idea.

### *Preparation*

We went to the company site and met up with one of the secretaries who is supposed to take care of the trash that is produced by the company. There had been an e-mail conversation between us, her, our project members and her boss. She told us that she had followed it and were able to understand what we wanted to test. When we wanted to install the prototype of our application, we asked if she or someone at their office owned a phone running the Android OS. According to her there was no one that owned one. Instead, we agreed on using regular text messages for the mean time. We agreed that the text message would contain what kind of recyclable they had (PET, cardboard, white paper or HDPE plastic), and if she could, give an estimate of the quantity of the trash altogether. We think that this solution works because we could still test the essential part of our concept idea which is to try to build a reliable relationship between collectors and local businesses that in the future may help formalize the work of the collectors in the city. Before we left, she showed us how the collector should go about to get to the trash. The collector that we send should ring the bell on a door a bit aside from the main entrance of the shop. Then the collector should ask for the person that is responsible for the handling of trash in the business and tell the security that he is from the LRO. Then the security person should help and make sure that everything went smooth. After the meeting, we (Rufael & Love) decided that we should get a phone with the Android OS that we could hand to our contact person in the business, so that our prototype could be used fully for the next test. For this test we had implemented a piece of A4 paper that contains information about directions and location of the business as well as instructions on how to go about to get to the trash (See Appendix B). This is something that we would hand to the collector to make sure that he/she finds the way to the business and knows what to do and who to ask for when he/she gets there.

### *Implementation and test*

We went to the satellite at around 9AM and waited for the text from our contact person at the leather business to arrive. We were around for about an hour, doing regular work and helping people around the satellite. At around 10AM we received a text from the contact person. It said: “Morning Rufael & Love. Please arrange for collection of 8 bags of shredded white paper and 20 boxes of cardboard.” We were immediately excited because we thought

that this was a collection that would be of value to most collectors. About 10 minutes later she also sent us the weight of the materials. The white paper was 18.4 kg and the cardboard was 17.2 kg. We kept hanging around the satellite station, during regular work, while looking for a collector that we could send. We knew that businesses did not want any drunk, irresponsible people at their premises. Therefore we had to look for someone who did not seem to be drunk. We also looked for someone that we knew was a recurrent collector that showed signs of wanting to do more work.

Around 1.5 hours later a collector that we had seen and spoken many times before came by with a lot of cardboard to be weighed and paid for. We decided that we should check if he was willing to do the collection at the leather business for us. We approached him and we greeted each other. After a small chat, we asked if he was busy for the moment. He said he had to do another pick up before having lunch, but after the pickup he would have some free time. We then asked him if he would be interested to do the pickup, he said yes and we explained where it was and what the materials were. He then asked who he should ask for when he got there. We then remembered that we had the directions map, so we took it out and explained everything to him. He then took the paper and went away.

Around 20 minutes later the collector came back with some other material and an orange trash bin. This was good, the trash bin would help him collect all the materials at the leather company easier. After that he went away again without speaking to us. It got us a bit worried because we did not know if he went to the leather company, if he forgot about it, or just postponed it because he got something else to do. We decided to just keep calm and wait to see what would happen. We were ready to pick up the materials in the evening if we had not got any news by then.

He came back again around 30 minutes later, with the trash bin overly filled and bags hanging from ropes that were tied with the other materials. We guessed that something took more time than usual, because the leather company is only about 5 minutes away by foot. After we had helped him to weigh the materials and after he had got paid (the total payment was 25 rand) for it we started to ask him questions about how it went.

He said that most things went fine, and that they were expecting him there. But he still had to go through some of the security there and sign papers that authorized his visit there. It seemed like the security people was cautious about letting him in, even though the directions map we had given him improved his legitimacy a bit. The collector also told us that he appreciated having the name of who he should ask for on the paper because he had learned many new names during the last period and had issues remembering new names. We got an idea on the top of our head while we were talking to him. The idea was to implement an order number in the procedure, which the collector could use to show that he is the person that we actually sent. He thought that it was a really good idea, because it would help him with the security issues at the business, and he knew that there are businesses with a lot heavier security than the one at the leather company. We thanked him, and he said the same and went off for lunch. He was going to have lunch at a place called the Service Dining Room. There you can get a hot meal for 5 cents, and it is mostly visited by homeless people who stay in the area.

#### *Results*

- The collector had issues with passing security. There needs to be something that ensures the people at the business that the collector is actually legitimate and sent by us on request from them.

#### *5.3.4 Iteration 4*

This test was made with the same leather company as in Test 3.

#### *Preparation*

We went to the company a couple of days before Test 4 to talk with our contact person there. We wanted to hand her the Android phone that we had got for her to use. We had installed the app for her before getting there, so it was ready to use. She said everything went fine on their part during the last test, and that they were prepared to do another one. We showed her how to use the app. We put the application on the home screen on the phone, so she just had to click it to open the app. Then she just needed to tick the materials she needed to be picked up and press the button that said “Message ‘the LRO’” (The LRO acts as a placeholder for the actual name of the organization). When she had clicked it, she would receive a message that said

that the request was successfully sent, and she would receive an order number that she would need to remember. That same order number would also be sent to us, and we would tell the collector to use it when he/she would pick up the trash. We told her that it was important that she would give the number to the security guards so that they could verify that the collector that came to pick up the trash was the same that we had sent and given the order number to.

#### *Implementation and test*

We arrived at the satellite station around 12AM. On our way there we met one of the collectors who we had seen multiple times at the satellite station. We stopped to ask him if he could come around in a bit. He said he could, but he had to do something later so if we wanted him to do the pickup for us it had to be soon. He then said that he was just going to get cigarettes and then he would be with us again. We saw this guy as a reliable person, but he was a bit more eccentric than the person we used in Test 3. This is a good thing because we want our concept to be used with people who are on their way of drinking less, showing more responsibility and reliability. It is supposed to work as a positive feedback loop (Meadows, 2009, p. 11) where progressive behavior is rewarded with more serious and valuable work.

We headed to the satellite station to set up our things. We opened up the front page of our web application prototype and saw that we had received a notification from the leather company. They needed to get white paper and cardboard to be picked up. We also received an additional text with information about weights and materials. This time they had 74 kg of cardboard and 3 kg of white paper. The collector came back after 5 minutes and we told him where he should go to pick it up and how he should get to the trash. We gave him a paper with the directions and instructions (See Appendix B), and noted the order number and said that he should use it when he rang the bell. We told him that there was a lot of cardboard, over 70 kg and that he probably needed a trolley, something that is a common tool amongst informal collectors around Cape Town (Petersen, 2014). He said he would check with some friends and went away.

He came back 5 minutes later and said he would get a friend to help him carry the stuff. We realized it was not enough to get everything at once, but he went off to get it anyway. About 10 minutes later he came back to the satellite station alone, carrying a load of cardboard on his head. It was a very hot day and he was dripping with sweat. He dropped it on the floor and ran off again, without saying anything. We weighed the load while he was gone and it showed around 20 kg on the scale. Around 5 minutes later he came back with a new load, which weighed about 10 kg. He went off once more without saying anything. Around 10 minutes after he went off, we saw him coming back at a distance. This time there was someone with him, and they were dragging a large bag full of cardboard, and some bags with white paper. It took them a couple of minutes to get up the street, the bag seemed very heavy. When they arrived, we had to be 3 people to be able carry the large bag onto the scale. The total weight was about 40 kg. We then weighed the paper and gave the two collectors their money. They got 31 Rand for the materials. We started asking the collectors how it went, they said everything went super smooth. The collectors that we had initially asked said that he went to the leather company and showed the security guards the directions map and the order number, and they immediately let him in. They also helped him package the materials so that he could carry it easier. He said that there was a lady who was worried about him because he did not have a trolley to use. He said that it was fine for him, he was used to carry stuff up and down the street, and the distance between the LRO satellite station and the leather company is fairly short.

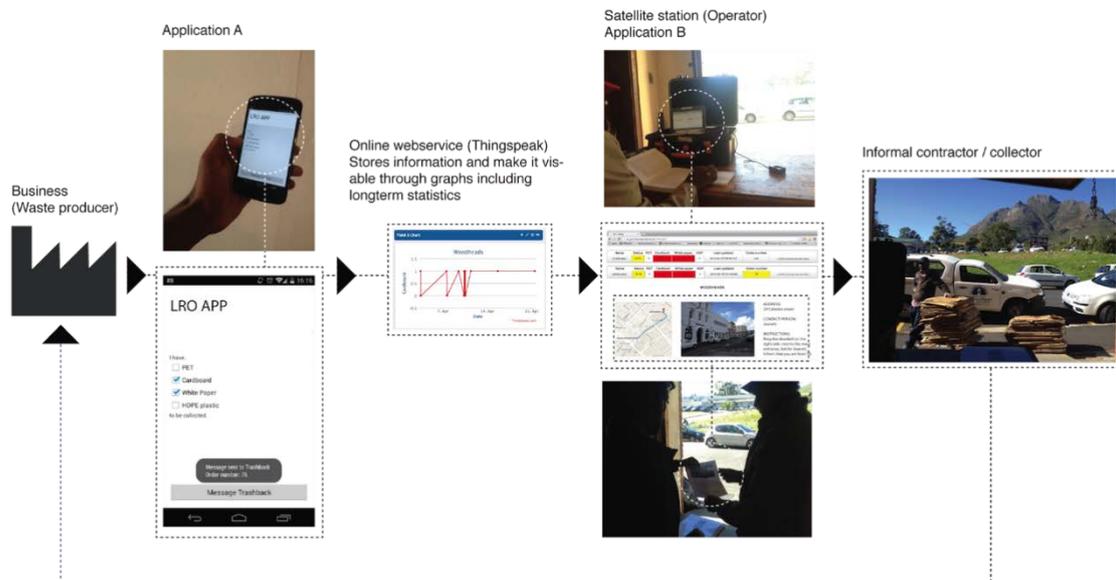
### *Results*

- Some businesses seems to be able to send information about how much recyclables they have. This is very valuable information to us. If we know this, we can make a better match of the carrying capacity of the collector and the need capacity of the business, before sending the collector to the business. This would provide more efficiency for collectors as they would only have to make 1 trip instead of 4. It would also be more efficient for businesses as they do not have to keep their premises open for a longer time than absolutely necessary. It would also mean that we know that everything has been going well and that the operation is done without having to guess about what is going on.

# 6 Results

## 6.1 Final Prototype

In the last iteration of the prototype we had included most of what we found that was important. There is an information flow that introduces waste producers and collectors to each other in a way that both of them feel comfortable with, in places constructed by them. The importance and definition of place is described in Harrison & Dourish paper 'Re-place-ing space: the roles of place and space in collaborative systems' (1996, p. 3). There is still work that needs to be implemented (see next steps, section 6.3) but what we have reached so far is: An easy to use mobile application for the person that is responsible for trash at a waste producer can use. The app makes it possible for the person to send a message for trash collection of different types of materials and gives the person an order number, which will be used to authorize the entrance of the collector into the premise.



Above. Fig 16. Diagram of final prototype (concept in context).

It also includes a web application that is being used by the person at the LRO who has a role as a human proxy. The app makes it possible for the human proxy to decide what capacity is needed from the collectors that is going to pick up the trash, and can notify the LRO that the pickup is completed and how things went. Thanks to the portability of the web application, the human proxy can sit almost anywhere and has a close connection to both waste

producer and collector, and can make sure that everything is being done on fair terms. The information system brings opportunities for collectors to make money, and an opportunity for local businesses to get rid of recyclables in an instant, for free.

### *6.1.1 Human proxy*

The human proxy is a model that makes it possible for us to evaluate the situation and in our view creates the most holistic view of the key-stakeholders that is possible under this particular circumstances.

In our implementation of the human proxy, the waste producer sent a notification to the operator (in this case us, in future scenarios, the LRO) of the satellite station via a provided digital mobile application. The operator then print the information of the notification on a paper and start to look for a collector that is recurring, and not intoxicated. This is because of two major points. First; The LRO works in a socially sustainable way and wants to give incentives to recurring collectors. Second; the businesses who are connected do not want any intoxicated persons inside their premises. By placing ourselves in the center of the information system, we could get a firsthand observation of how the collectors experience our concept, while facilitating the assimilation of ourselves in the context, leading us to what Sanders (see section 3.1.2) refer to as a tacit understanding of the situation.

What this method offer in difference from traditional anthropological fieldwork, is that instead of only being an approach for research, it also serves as an integral part of the final design solution. An important part of this method is that the designers hold the responsibility to gather information from all stakeholders and then distribute it among them. This results in the ability for the designer to create a sustainable solution that suits all stakeholders.

*The human proxy acknowledge the fact that successful design is grounded in understanding the human and her behavior in the specific context. It has shown to be the most valuable tool in our research.*

## *6.2 Discussion*

Our view on how to conduct design has been radically changed. It is now clear to us that as designers we need a better understanding in the social and anthropological fields. How can we actually provide a solution of anything if we do not understand the user? As interaction designers we do not just provide a solution based upon others research, we need to be the researchers ourselves. As a functional part of our society and its norms, rules and behaviors, we can understand some fields in our own context, but as soon as we are pulled from our context we need to, even more, involve the people we designing for. We have found that ICT can be used to facilitate communication across social differences, but our research also show that the involvement of a human component is essential. We have the capacity to understand and interpret situations that any viable technology today does not have. There is a need to be able to perceive the radical difference of situations that can arise from the interactions between the complex social divisions.

The problem of involving ICT in solutions that tries to facilitate communication between stakeholders in this context, is their differences in experience of understanding technology and the radical difference in social status. The main reason why we do not think that a fully digital solution to the problem of communication across social divides will work, is its incapability to adapt to changes. Through the LRO, we have found a place where communication between collectors and local business/waste producers can take place in a way that is natural and beneficial for both of them. Our design solution has helped bridge one of the LROs goals, which is to make the collectors work more visible and accepted by the community.

## *6.3 LRO Next steps*

We worked in close collaboration with the LRO. They had their specific interest and goals regarding our participation, the prototype application and our research. As they showed interest in continuing our concept, we put together a list of findings and recommendations which we have added as an appendix (see Appendix C).

## *6.4 Credits*

We want to express our gratitude towards the socially complex individuals that made our research possible.

Andrew Putter, Jörn Messeter, Evan Blake, Micah Donnoli, Julia Raynhan, Rael Futerman, Andrew McNaught, Kathryn Warner, Richard, Gerald, Miss Jacobs, Danielle Ehrlich, Ken, Amanda Bergknut, Lars Holmberg, Shorty, Carlo Randall, Marijke, Cathy.

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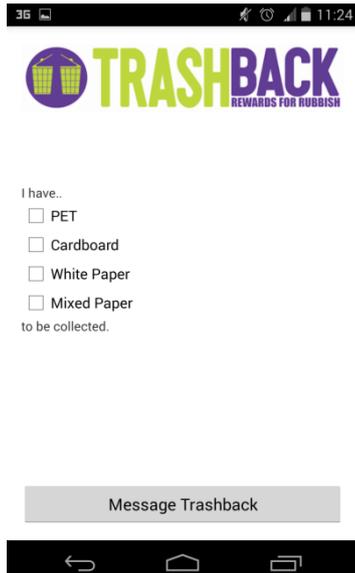
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# 8 Appendix

## Appendix A

Here you find screenshots of the Android application and the JQUERY-based web application

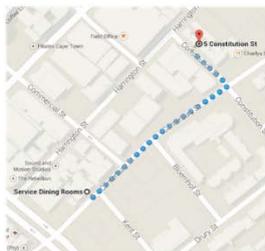


Name	Status	PET	Cardbord	White paper	HDP	Last updated	Order number	
STUDIO MAS	0110	0	1	1	0	2014-04-15T06:56:14Z	null	Confirm receiving and reset values
WOODHEADS	1011	1	0	1	1	2014-04-23T12:14:48Z	38	Confirm receiving and reset values
JOULE CITY	0000	0	0	0	0	2014-04-03T12:08:30Z	0	Confirm receiving and reset values



Name	Status	PET	Cardbord	White paper	HDP	Last updated	Order number	
STUDIO MAS	0110	0	1	1	0	2014-04-15T06:56:14Z	null	Confirm receiving and reset values

### STUDIO MAS



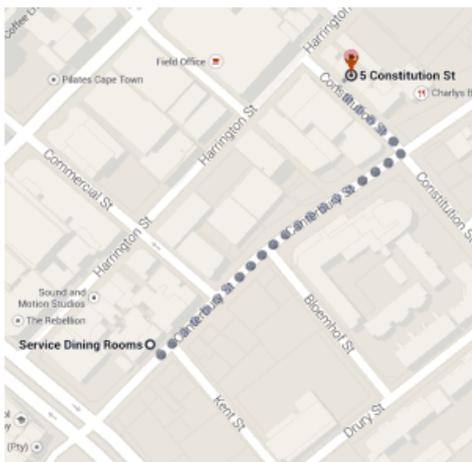
ADDRESS:  
5 Constitution Street

CONTACT PERSON:  
Cathy

INSTRUCTIONS:  
Ring the doorbell,  
Ask for Cathy, inform that  
you are from Trashback.

# Appendix B

This is an example of the lo-fi prototype handed to an informal collector.  
Printed at the satellite station via the web application.



## studio MAS

ADDRESS:

*5 Constitution Street*

CONTACT PERSON:

*Cathy*

INSTRUCTIONS:

*Ring the doorbell, Ask for Cathy, inform that you are from Trashback.*

# Appendix C

This is the list of recommendations and findings that we gave to the LRO.

## **SDR = Service Dining Room**

### **People**

#### *Businesses*

- Janitors: Good contact persons to have at businesses. Often knows more about the trash handling at the business than anyone else.
- Secretaries: The first persons we have been appointed to after getting “approval” of testing our things with the managers/owners
- Owner: Get their trust in the idea, tell them we will take care of it.

#### *Collectors*

Two types of collectors:

- Recurring collectors. They come to Trashback at least 3 times a week to hand in trash. Try to give pick-ups (i.e. a request from a business to pick up trash) to these persons. Make sure they know the directions to the pickup and the procedure once they get to the business.
- Sporadic collectors. Impossible so far to make out any patterns associated with these collectors.

#### *Trashback*

Two people at the satellitestation are needed, at least in next step:

- Operator of satellite station: This is the person that weighs waste, inputs data about the collector into the system, and pays the collector.
- Matcher: We think this role is essential if you intend taking the social dimension of the business seriously.

It is unlikely that the Operator and the Matcher can be the same person - they are both time-consuming roles. The Matcher must have an ethnographic understanding of the changing needs of the collectors, and the people in the businesses, and of the key people in Trashback. It requires sensitivity to complex social divisions. This would be someone like Evan. Once the business has grown, it might have the capacity to train ex-street people to take on this role. The Matcher must also understand the invisible ways in which non-street people misunderstand street people. Main drivers (Kat+Drew).

#### *Other*

- Local businesses or property owners who cannot handle the presence of street people in the area. It is important to take these people seriously, as they could derail the business.
- City security forces of various kinds. Each of these kinds has a different agenda, and the individual security guards who work for them are often uneducated, speak a first language that differs from the collectors, and is paid a very small

salary. Communications in this realm are structured by many complex factors.

### **Mental/Psychological issues**

#### *Habits-The Collectors*

- Our limited experience has been that many Collectors in our pilot collect in the morning, have lunch at the SDR, then drink - probably from the local bottle store, but we are not sure. Some Collectors drink in the morning too. Collectors who have obviously been drinking can't be sent on a pick-up from businesses.

#### *Attitudes- Collectors*

- Attention span. Many collectors we worked with seemed enthusiastic in the moment, but after a relatively short time (an hour or less?), their interest waned.

This is probably caused by a number of factors in complex interaction. Collectors might need to be keeping their attention on other options for gain; they might not have enough energy/food/etc.; they may need alcohol/ drugs, etc.

- Attitude to time. Collectors' may work with time in ways quite different to other stakeholders in the Trashback ecology.

Collectors may not have watches. They may lose track of time in different ways. It might be easier to do something immediately rather than be told to have to wait until a future time. A lot of misunderstanding can happen here, so it would be good to be sensitive to these differences as they emerge.

#### *Current system design*

In our opinion Broccoli is badly designed. From an interaction design point of view it fails. Designing a system that is really understood by its key users requires careful design and testing. It cannot be done without the regular input of users. The flow of the interface must correspond to the flow of the actual procedure. Irritation arises when the system (Broccoli) fails, which it does easily due to the lack of connection between the interface and the flow of the actual procedure (from the Collector's point of view). This creates a queue of collectors, creating tension for Collectors and the Operator.

#### *Trashback staff*

Appearance (clothing, etc.) can be an area of big difference. We are unsure of the effects of these differences. For example, does a smartly dressed Trashback staff member intimidate a Collector (or make them feel like they can't identify with that staff member), or does it make the Collector feel validated to be taken seriously by a smartly dressed person - or both of the above? Further research needed.

#### *Businesses*

Some businesses have the right attitude to get involved. Start with these. How do you quickly identify if a business has the right attitude? What are the different dimensions of that right attitude (social upliftment, environmental sustainability, neighborliness, etc)? How do you change a business's attitude quickly?

## **Social**

### *Economic - Collectors*

They seem to operate very opportunistically - i.e. in the short term, not easily able to think of the future. *Social relations/divisions*- attention span - Relationships between collectors/street people & CCID/ELISA individuals  
It is good for people like us to be able to melt in at the satellite station. Dress and act as if you are ready to do the work there. This will facilitate communication to happen in a more natural way. Produce trust between collectors and businesses.

## **Environment**

### *Local geography*

- We have only been testing the concept with companies that are situated within ca 200 m of the satellite depot. It might be a good idea to try the concept further with companies that are in a close-by distance.

### *Logistics*

- The lack of trolleys or even lendable trash bins makes logistics a bit inefficient sometimes. When working with businesses such as woodheads, one trip on foot seems to be too less to handle it pickup effectively. It would be great if the Matcher would have access to lendable/rentable trolleys or trash bins to be able to make a good match of the carrying capacity vs. the capacity needed for the pick up.

## **Place**

The concept has been tested from only one particular place, which is the satellite station on Canterbury Street. It would be necessary to test it from another place that is not close to the liquor store, SDR etc. to see if the same design works at other locations as well.

## **Technology**

Keep things open source! We have been using Android and Thingspeak which are both open source alternatives. It had made us able to do things with practically no budget at all and no (stupid) restrictions. Try to make software that is as cross-compatible as possible (same software should be able to run on different platforms)

## **Concept**

To be able to fight the social issues between the collectors and the businesses operating in the area we developed a way in which they would communicate more directly with each other. We think that there needs to be something that bridges the gap, both by making that the work that the collectors are doing more visible to the businesses and creating more opportunities for the collectors to be able to make a living for themselves. We are going to try to give local businesses the opportunity to message the LRO when they have trash that needs to be collected, and then having one or more of the collectors of the LRO picking it up, and then getting paid for the service by the LRO.

## **Next Steps/Recommendations**

### *Next steps*

- Automate registration process in the applications, perhaps with new interfaces that will be available to trashback.
- “Smart bins” is also a possible next step but, still keeping a human proxy for interacting with Collectors. Smart bins would be something like a set of sensors that has thresholds for messaging the satellite station when the bins are full. Preferably try to prototype this with Arduino (open-source hardware for prototyping), as it will be able to connect directly to thingspeak

### *Recommendations*

- Have a human proxy(matcher?) at the satellite, do not even think about making the concept fully digital at this point
- Build steady relationships with other businesses, explain what is going to happen and keep in touch with them. Another person might need to do this.
- Keep using Thingspeak, but set it up yourselves on a private server. Keep researching mesh network possibilities.
- It could help if businesses made their trash more available to the collectors. It will help the smoothness of the operation: less people in the business may be disrupted; it will be less stressful for the collectors (less to have to remember, etc.).

### *Incentives for Collectors:*

In discussion with Evan Blake, we believe that incentives should not be forced on Collectors. This will drive them away. If a Collector leaves Trashback, they might return to the street in an even more vulnerable position than before they left. It is better to offer cash, as this allows Collectors to decide how to use the value they get from Trashback. Collectors are the experts of their own everyday experience and know the complex needs of their situation much, much better than anyone else can. As Trashback learns what the specific needs of Collector are, they can experimentally add incentive: coupons for cheaper food, shelter, etc., training/ education; opportunities in the business, etc.