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## Waste retrieval services in Ibagué: a social design approach

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### ABSTRACT

Colombia has doubled the amount of waste it generated at the end of the nineties. In less than 20 years, the country, through its constant push for 'development' based on exploitation of natural resources and with the increasing entrance of international products, has created a future scenario that is worrying in terms of waste management. Very poor environmental education and cultural difficulties in passing from law to reality have turned the entire country and its landfills into time bombs. In such terms, dealing with this issue is a learning-while-doing process that cannot be ignored. This paper addresses two groups of people involved in the waste management of Ibagué: the retrievers, and the generators, of the waste. This study summarizes a human-centered design approach to the issue with a focus on the retrievers as an essential actor of the waste management chain in the city, and is based on a case study developed in one of the main suburbs of Ibagué. Their labor conditions, their social needs and the perspective they have of waste were the main resources for developing five design criteria to be considered when designing a waste retrieval service for Ibagué.

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Recyclable waste; social design; retrievers; generators

### The waste context in Ibagué

The case study of this paper was developed in Ibagué, an intermediate city in Colombia located three hours away from the capital of the country. In terms of population, and in accordance with the National Administrative Department of Statistics (DANE, according to the Spanish), Ibagué had a projected population of 553,524 inhabitants for 2015 (DANE 2013). The majority of the population (490,423) is part of the lower and middle classes and earns between 36 and 1,700 US dollars per month. The unemployment rate of this majority is higher than that of the upper classes in a city that has continuously been on the list of the highest unemployment rates in the entire country. Unemployment had led to many informal job options with poor safety and payment conditions (Aluna Consultores 2011). In addition, various studies have shown a genre differentiation in terms of payment in both formal and informal jobs (WIEGO 2009; Canales-Herrada 2013). In contrast, the upper classes tend to earn between 2,500 and 10,000 US dollars per month, but represent just the 5.5% of the population in the city. The living conditions in Ibagué, in terms of incomes and social classes, are therefore not very equitable.

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Among the above-described majority population in Ibagué are those who collect and sort waste materials from waste bags disposed of on the streets of the city. These people, who are to be described as the retrievers<sup>1</sup> work in very poor conditions, far from those defined as 'proper' by the ILO (1999, s.f) or 'worthy' by the Colombian Government (PGN 2012). Criteria in this regard include: the amount of hours dedicated to their occupation; access to safety and social security; income per hour; exposure to risks, and possibilities to improve their labor conditions. From research conducted as part of the case study described in this document, it has been found that the average retriever in Ibagué has only primary school education, works 14 hours per day (Sánchez 2014), faces diverse and high risks,<sup>2</sup> has an average income per month of 150 US dollars, has no health cover and no safety tools, has been a retriever for more than five years, and has either inherited the job or became a retriever because no other job options were available (Aluna Consultores 2011; Sánchez 2014; WIEGO 2009).

On a normal day, the retriever leaves his/her rented home at around 4 am, walks to their 'workplace,' searching on the way for bags with recyclable materials, arrives at the workplace, and defines the day's area of work in accordance with other retrievers in the area. Subsequently, the retriever defines a route and starts opening the waste bags on the streets with two main conditions: (1) searching has to be done before the waste-collection truck passes and (2) the type of waste to be recovered depends on what is in demand by the *chatarrerías*<sup>3</sup> in the city for the day. After having defined his/her route, the retriever takes the retrieved materials to his/her workplace<sup>4</sup> to sort it by type of material (e.g. plastic, metal, paper, glass, etc.). Later, when the material has been sorted, the retriever takes it to these informal businesses, which pay depending on the type of material, its weight and condition. Finally, at around 6:30 pm, the retriever returns home with some extra material to clean and sell next morning to another business. Retrievers represent examples of what many people in the lower classes in Ibagué and Colombia are and do for living.

Retrievers in Ibagué work with waste generated in a particular way, similar to the majority of cities in Colombia.<sup>5</sup> Normally, the generator of waste in Ibagué uses standardized black bags of 65 x 100 cm for any type of waste. The waste generators then dispose of these bags using two possible methods: using their building's 'chutes,' or taking the bags to collection points in the streets. The first method is used by generators who live or work in buildings with a hollow column (the chute) that connects all the floors with the waste room in the basement. This allows the generators to throw their waste from their own floor, and requires an employer<sup>6</sup> to take the building's waste to the waste collection truck on the defined collection days. The second method is used by generators who live or work in small buildings and who gather all the waste from the building into one large bag, which is taken outside to an informally defined 'collection point.'<sup>7</sup> In this case, there is no defined person to take the bag outside. The bags disposed of on the streets are picked up by the waste collection truck and taken to the municipal landfill.

The municipal landfill in Ibagué (La Miel) is one of the best in Colombia, being able to produce sterilized water from the leachate after primary, secondary, and tertiary treatments (López 2013). However, as many of the towns close to the Department of Tolima have not been able to meet the conditions for waste management stipulated by the Government, their municipal waste is also being disposed of in this landfill together with that of Ibagué. Due to the volume of waste received in this landfill, implementing formal sorting and recycling activities are not cost-effective (López 2013). Thus, even though the municipal landfill

has an excellent infrastructure, external conditions, such as the poor infrastructure in the nearby towns and the poor education on waste management in Ibagué, are decreasing its lifespan and limiting its possibilities for instigating recycling services.

Although there is a Regional Plan for Waste Management in place (Cortolima 2012), much remains to be done in order to define and establish a complete route for each type of waste in Ibagué. This includes a clear path for toxic, hospital, and 'common' waste with various certified providers who manage the waste of the entire city (López 2013; CORTOLIMA s.f.,). However, the same structure is not organized (and in some cases does not even exist) for other types of waste, such as organic, metal, glass, electronic, and recyclable waste, which does not have defined service providers (Secretaría de Salud 2015; Secretaría de Ambiente 2015). There is also a lack of legislation defining the structure, characteristics, and methodology for their management in the region. Moreover, the majority of the waste is assumed as being *ordinarios*<sup>8</sup> (ICONTEC 2009), and is thus taken to the regional landfill.

In rural areas there is very limited waste management infrastructure, and its provision is difficult because of the condition of the roads, which are not adequate for the large collection trucks. In addition, many farms are too distant from the waste management infrastructure. There are very few providers of waste management services in many rural areas, and some towns have to either manage waste under inadequate conditions (Gualteros 2013; López 2013) or pay large amounts of money to providers in the main centers (López 2013). These and other difficulties align with the limited regional plan for waste management, resulting in many rural inhabitants managing waste in private and unstructured ways, including burning it (CORTOLIMA 2005). Burning is the socially accepted method, as it prevents the accumulation of waste and 'nourishes' the soil with the minerals remaining after burning (however, waste is not separated; food, green, and toxic waste such as pesticide containers is all burnt together). Another reason for the scarce waste management in rural areas is the centralization of public efforts, which drives attention and economic resources to the main populations, despite the fact that there are contamination issues related to the way waste is dealt with in many rural areas, such as Tolima.

As can be inferred from the description above, the generation, disposal, and retrieval of waste all evidence that the processes in Ibagué are 'disconnected'. The disconnection is more significant among the actors involved in the city's waste management, each of whom seem to ignore their role in the waste management chain, the existence of the chain, and the consequences of their actions for the other actors. Considering the entire waste management as a chain of processes, and each subprocess as a chain link with its related actors and activities, we propose that enhancing the connection between pairs of links, through the understanding that each link and its relation with the next would not just generally 'connect' the entire chain, thereby improving its efficiency, but specifically improve the conditions of each link.

## Methodology

In these terms, the first two links of the recycling chain were selected for a social design approach to understand each of the links. One of the biggest and most important mixed<sup>9</sup> suburbs of the city was selected for a case study on the waste generators and retrievers. Over a period of two months, retrievers of the suburb of Cádiz were interviewed and observed by accompanying them during the retrieving routines; this allowed the researchers to fully

understand their practices, and, in particular, establish a valued human connection with them. The generators of the suburb were also surveyed, their disposal practices were observed, and some of them were interviewed as a focus group. The information obtained from the observation processes and surveys was 'translated' into infographics and transmitted to the actors involved. In addition, the data gathered from the observations, interviews, and accompaniment was translated into a multi-causal diagram showing the connections between practices, attitudes, knowledge, and conditions within these two selected links. This diagram was combined with the interviews to define an initial description of what the actual situation of recyclable waste management is in Cádiz, and through the eyes of the first two links of the waste management chain. We believe that further stages should now be developed to define strategies to improve the connection between other chain links, and the waste management efficiency as a whole.

## Findings

Among the different actors in the waste management chain in Ibagué are the generators, who can be defined as those who dispose of waste. This actor is therefore in charge of the amount of waste generated and moved along the waste management chain, and is also the main actor related to source sorting. However, generators in the study were not aware of their role and neither sorted their waste nor disposed of it properly. When asked about types of waste and recycling, the generators answered correctly in the majority of cases, indicating that they were aware of what is recyclable and what should be separated; they even declared that recycling is very important for the environment and that it should be done. Thus, the question arises as to why they do not do it. There are several explanations for this behavior.

For instance, many of the generators used to sort waste but decided to stop the practice when they saw that the recycling chain did not work as expected. In a first case, some generators stopped sorting (or never started) when they realized that all the separated bags were thrown indifferently to the waste-collection truck, so it made *'no sense doing all this effort when everything will go to the same place'* (Generadores 2014). Second, some stopped sorting due to negative experiences with the retrievers, especially when observing them tearing the bags and leaving the waste displayed in front of their houses.<sup>10</sup> Others said they could not find the same infrastructural, educational, and governmental conditions in Ibagué as they had in their hometowns, where sorting was compulsory. The fourth case includes those who had never sorted waste because they did not know how—this can be related to the third case in terms of the absence of guidance and structure to inform them. Thus, there are multiple possible causes for the nonsorting behavior of the generators—this means that the situation cannot be adequately analyzed in a linear and synthetic way, but rather needs to be done using a more systemic and analytical approach.

There are also many reasons for the actual conditions and practices of the retrievers. The torn bags, which the generators dislike, can be explained as follows: Retrievers earn according to the recyclable wastes they can collect but, as there is no home-sorting<sup>11</sup> culture in Ibagué, they have to collect waste from the bags on the streets. However, as these bags are disposed of and collected in accordance to the schedule of the waste collection truck, retrievers have to sort through the waste before the truck passes by. This implies a strong dependency between the amount of waste the retrievers can collect and the speed of the truck and its

schedule. A faster truck or an earlier schedule normally forces them to speed up their processes, resulting in the need to tear open the waste bags as a faster method to search for the recyclable waste. In such terms, the dependence of retrievers on other actors (i.e. generators as sorters and waste collection trucks as collectors) condition their practices even in ways that could be undesirable for those actors they depend on.

Another interesting relation in the waste management chain is that between the retrievers and the homeless of the city. According to the generators interviewed, homeless people and retrievers are considered the same group of people (Generadores 2014), meaning that their practices are assumed as being equal. This is because there are many similarities between retrievers and homeless, such as searching through bags for waste, earning less than minimum wage in Colombia, and not having a 'clean' image (Generadores 2014). However, there are many differences between these actors, which are related to their perspective on waste and are evident in the time they dedicate to waste collection, their methods, the use of their incomes from waste collecting, and the importance they give to relations with the other actors in the waste management chain (Sánchez 2014; Luna 2014). Homeless and retrievers are thus two groups of people whose economic needs make them coincide in terms of the waste bags, but whose differences give them two very different perspectives of the waste—perspectives that are not visible to the generators.

We relate the 'invisibility' of these differences to disconnections between the chain links, as described above. Retrievers and generators in Ibagué do not articulate their practices because they do not relate to each other as social actors with a shared, problematic situation. Having said this, in some rare cases where there was an approach between the two actors, the relationship between them changed, as did the way they managed the waste. During the case study, this was evident in two possible ways: either the retriever approached the generators with the intent of forming a sort of 'loyalty' regarding the direct delivery of waste, or the generator, curious about what the retrievers do, went to a retriever. We highlight this relation as highly valuable, as it has many positive consequences for waste management practices. In particular, it empowers retrievers, who switch their usual role to one in which they are teachers of generators in terms of how and what to recycle. The retriever image changes for the generator, transforming the retrievers from 'dirty people related to waste' to 'those people who work with rubbish,' creating 'their source of income' while 'helping the environment.'<sup>12</sup> It is suggested that such changing relations should be the focus of actual and future actions and research.

Doña Martha, one of the suburb's retrievers, intuitively understood the importance of the link between the actors in the recycling chain, and had designed several strategies to improve the connections. In particular, she noted that having 'cordial relations' with generators and with the personnel from the waste collection truck improved her 'timing' during retrieval routines in Cádiz. Her strategy started by knocking on the doors of the generators of the suburb, introducing herself to those who opened the door, and telling them she could help with the delivery of waste to the collection truck if they gave it to her when she rang their doorbell. The strategy was clever; it not only allowed her to be recognized by the generators, but also created 'loyalty' in the delivery of waste as these generators actually gave their waste to her alone, and some minutes before the truck passed. The strategy also reduced the risk for Doña Martha, because the direct delivery (receiving the waste directly from the generators) decreased her exposure to car accidents<sup>13</sup> and illnesses related to vectors such as mosquitoes and street animals.<sup>14</sup> For the generators, the strategy was beneficial as it reduced

the possibility of animals and homeless people ripping open their bags and, more importantly, meant they would not miss the collection truck with its ever-changing schedule. Doña Martha's intuitively designed strategy was thus beneficial for both actors, not only in terms of the operational activities related to waste management, but in relation to creating social connections between them.

To make the strategy work, Doña Martha also needed to connect with the personnel of the waste collection truck in order to arrange her schedule and route. She noted that she needed to know the exact routine of the collection truck so that she could arrive at the houses in good time, search the bags without making a mess, and then take the bags to the truck. To do so, she paid attention to the truck schedules for about a month and, in accordance with her findings, designed her route to include the direct-delivery houses and collection corners in the suburb to which she could take the directly delivered waste. She also realized that she needed to meet the personnel working on the truck before each route. In particular, she needed to know who was driving the truck as this was the person who would determine the timing of the waste collection. The hardest part of making connections with this actor was that she could not know which person would be working on the route each day until she saw them on the morning of the collection. Doña Martha developed a 'cordial' relation with these personnel, though it was sometimes tense depending on who was on the truck each day, or depending on the orders given to the truck personnel by the waste collection managers. Her intuition led her to become a designer of her practice, who read the environment around her, understood the actors involved, and, in accordance with these two readings, proposed a strategy with benefits for all.

Evidently, there are many variables that should be considered for this and other possible strategies to work. From the generators' point of view, trusting the retrievers is necessary before giving them waste and keeping to a routine of 'direct delivery.' However, this trust depends on many factors, which are mainly related to overcoming social stereotypes of the retrievers as 'dirty,' 'poor,' and 'violent.'<sup>15</sup> This was noted by CORRESUNTOL, a retrievers' association in Ibagué that introduced the use of work vests to improve the image of retrievers to the generators (Luna 2014). The vests bore logos of the municipality, therefore associating the retrievers with the Government and beneficial environment practices. Moreover, identification cards certifying the retrievers as belonging to an officially recognized association further improved their status. Even though the vests worked very well for the generators (Retrievers 2014), these elements were referred to as a 'problem' (Retrievers 2014) for other retrievers who worked without vests and cards.<sup>16</sup> It is evident that image is a key variable that opens the doors of the generators but is also related to other variables for the retrievers: the importance of belonging to a social group, the risks related to other actors, and their own self-differentiation.

Of the above variables, self-differentiation warrants further explanation. The majority of retrievers work in this role either because 'they have no other option,' 'don't know how to do any other thing,' or because they inherited the job (Aluna Consultores 2011; Retrievers 2014; Sánchez 2014; WIEGO 2009). In the same way, the majority of retrievers in Ibagué have a very low educational background, and some have physical or mental disabilities that prevent them from working in other jobs (Gualtero 2013; Sánchez 2014). In these terms, their social conditions reinforce a poverty cycle for them and their families. This cycle affects both their socio-economic and personal opportunities; there are very few cases of retrievers coming out of that cycle. The self-esteem of a retriever is constantly affected by the labor conditions

described above (Retrievers 2014). Therefore, making changes to the management of recyclable waste in Ibagué would not only represent an improvement in waste management for the city, but a bigger improvement in the social and human conditions of more than 297 families (Aluna Consultores 2011) in Ibagué.

In order to design strategies and improve waste management services for Ibagué, understanding the particularities of the specific context is essential. One of the first findings of this research was that, as in many other parts of the world, many solutions for waste management were brought to the city without an understanding of the place and its people, and these initiatives thus failed. One example of this is when the municipality donated several pushcarts to the retrievers of the city that soon broke, as they were inadequate for the street conditions and labor routines. The pushcarts' weaknesses were soon noticed, and the carts were then sold as recyclable material by the retrievers. This case exemplifies the most common problem of adopting other countries' solutions for waste management: without having the supporting infrastructural, educational, and economic resources, it will not succeed (Aluna Consultores 2011). Ibagué's waste management solutions must be coherent and planned in the context, and in accordance to its people, place, economy, and culture.

The above statement influenced how the authors addressed the retrievers, the generators, and the methodology of the present research. As part of this, two months were dedicated to working with the retrievers, three times a week and for at least three hours a day. The work was developed with the group of retrievers in the suburb of Cádiz, but mainly with a family of retrievers who opened up their lives to the authors (and to whom we are extremely thankful). The strong connection developed between the authors and the retrievers allowed for better comprehension of their roles and work, and provided highly valuable information for designing possible future work-based scenarios with them. The following is a summary of what they shared with us, and is written with their permission and with the aim of showing an example of a retriever's life in Ibagué.

Doña Martha and Don Orlando live with their three sons two hours away from Cadiz in a rented room. They work in Cadiz on Mondays, Wednesdays, and Fridays, but sometimes also Saturdays. They use the rest of the week to either sell the material retrieved or to retrieve in other places of the city if 'the day was hard'.<sup>17</sup> When working in Cadiz, they wake up at 4.00 am and walk from their house to Cadiz, retrieving what they can find on their way. On arrival, they divide their roles: Darwin, the eldest son, stays at the gathering place in the public park, while Doña Martha and Don Orlando focus on the bags they know are the most useful in the suburb. After collecting this first 'batch' of waste bags, the waste collection truck arrives, allowing Doña Martha and Don Orlando to see the day's route, the personnel, and the length of the workday. In the majority of cases, they start one block ahead of the truck's starting point, which keeps a time gap between them and it. They go to different points in the suburb and cover the area around it, in order to be more efficient. Each time they fill a large-sized bag with waste, they have to take it to the gathering point, where Darwin receives it and starts sorting the waste by material while protecting it from other possible retrievers and homeless people interested in these bags. At around 10.00 am, and having repeated this process several times for about three hours, Doña Martha and Don Orlando finally go back to the gathering place to join Darwin in the sorting process. This ends at around 3.00 pm, when they pack what has been retrieved and take it using a rented pushcart to a buyer they trust. The selling ends at around 6.00 pm, and they arrive back home at 7.00 pm.

The above-described workday represents 14 hours of work for the family, time during which Darwin's youngest brothers stay home alone or go to school, if the earnings allow the family to do so. However, many retrievers take their children to work if they have nobody to care for them. When asked about public daycare, the retrievers said that they do not trust the public system as 'all they want is taking our babies apart from us' and 'they don't treat them right in the day care, especially if they know they are children of retrievers' (Retrievers 2014). Moreover, some of the retrievers interviewed said they find no risk in having their children with them while retrieving as 'we were raised the same way and, look at us: we are perfectly fine! (...) It will always be better for a child to be with his mother, and we have to work' (Retrievers 2014). It is evident that all of the above-described risks related to retrieving are shared by the members of the family who accompany the retrievers, but, as argued by the retrievers, this accompaniment makes the labor more efficient by distributing the activities among members of the family and keeping the family together.

Doña Martha started as a retriever five years ago, when Don Orlando, who used to drive large trucks, had a car accident and lost his job. Like many people in Colombia, he was working under informal conditions, without a proper contract or social security that could have given him indemnification. He was fired, injured, and had a family to feed. Following this, and in response to the urgent needs of her family, Doña Martha started retrieving plastic bottles from the waste bins and selling them. After three months of doing this, she was able to stabilize their familiar economy and decided to become a 'full-time retriever' with her husband. This story made Doña Martha 'very grateful' for the labor, which she 'love[s] doing' because 'one has to love what one does.' It has allowed her to 'save her family,' provide Darwin with some education, and even 'change her living room and house decoration' several times through others' waste. Her studies in childhood pedagogy have not been useful in her current life and so have been left behind. She even lost interest in finishing her thesis project, the only thing missing for her to obtain her undergraduate certificate. Although being waste retrievers was the desirable option, it was the best one they had in order to survive, and in accordance with their environmental conditions and available resources.

There are, however, some things Doña Martha dislikes about being a retriever in Ibagué. For instance, she is not comfortable with the payment for the work, which does not represent the amount of work done and requires them to work all year long. In addition, she dislikes the routine, which has absorbed her entire family. However, what she dislikes most is the treatment others give to all the members of her family even when they 'are doing a service for them.' Many examples of this were observed by the authors during the time shared with the retrievers, such as when people avoided passing by the family on the street, or when some generators gave them a bag with recyclable waste but also containing human feces. The authors also witnessed how the collection truck personnel (and many generators) ignored Doña Martha, but talked to the authors as if she was not there. The treatment described and the aspects Doña Martha dislikes indicate what is problematic between generators and retrievers and that needs to be redesigned. However, the things Doña Martha likes are aspects that need to be optimized in the design of practices as a more developed service.

It was also possible for us to understand the perspective of the generators while conducting the fieldwork. In general terms, the majority of inhabitants of Cádiz are families who have lived in Ibagué since Cadiz became one of the most exclusive suburbs of the city, as it is full of big houses and close to the main street. These families tend to own their two-story

houses, which are occupied by three generations (grandparents, parents, and children), all of whom tend to be away all day working or studying somewhere else in the city. Those remaining at home are normally hired housekeepers or retirees, both of whom take care of the house and conduct activities around the suburb, such as walking, chatting with friends, or just observing from their balconies the goings-on on the streets. The person in charge of taking waste bags out are normally either the housekeepers or the parents of the family, and this activity can happen either the night, before the collection truck passes; as soon as the generators arrive home and finish dinner; or in the mornings, just before they leave for their daily routines.

Due to the profile of the inhabitants and the suburb's location, many medical offices, banks, and insurance firms have been established in the suburb. These businesses take advantage of the suburb's characteristically large houses, which do not correspond to what an actual middle class family in Ibagué would like or may afford (Generadores 2014). The cost of living in Cádiz is no longer affordable for the next generations of families who, composed of fewer family members, prefer smaller places, such as apartments in other suburbs of the city, and sell or rent their large houses in Cádiz for business use. Business owners mostly stay in the suburb during working hours (8–12 am and 2–6 pm), though some health-related business are open 24/7. The waste generated tend to be either office waste (paper, plastic, etc.), organic waste (mainly from restaurants) and what is defined as special waste, which includes toxic, human, or animal-derived waste (coming from clinics) or dangerous waste (such as syringes, contaminated clothes, etc.). It is important to highlight that the majority of these types of generators declared having been trained to separate waste types at source, particularly those working in health-related business, as required by law. However, when asked about some common waste types, such as Styrofoam, Tetra Paks, napkins, or even food, many did not select the correct corresponding waste bag.

The type of business practices, the level of education of their owners and their incomes, plus their daily routines, all combine to create very different waste from that which the retrievers usually encounter. However, generators share the waste management system with the retrievers, as well as the consequences of its development. It is interesting to note that retrievers are more conscious of their relation to the generators, understanding them as the source of their raw material, and even viewing them as clients. For instance, retrievers know from experience that there is a strong connection between the type of waste generated and the socioeconomic level of the generators. Poorer and less advantaged classes mostly generate organic and general waste. In contrast, wealthier people discard things like plastic, boxes, clothes, electronics, and even jewelry. This knowledge allows retrievers to better select the retrieving area or change the normal one if the 'workday has not been good.'

## Results

As can be seen from the above, there are many cultural aspects and types of relations between the two actors, generators and retrievers, in this broken chain. The valuable information provided by the actors creates a 'picture' from which the actual situation of the retrieval service in Ibagué can be better understood. This picture is full of variables, relations, and 'soft' information that needs to be diagrammatically represented in its complexity. Therefore, we use a multi-causal diagram. The diagram allowed us to understand the 'whole picture' and then categorize it in terms of attitudes, practices, and knowledge of each of the

described actors. This information, as a description of what happens today, allowed us to identify what can be redesigned, optimized, and eliminated, and how, for the specific context.

Considering that design criteria are the 'basic characteristics a design must have order to be successful and in order to be developed and evaluated' (MHHE 2001), various design criteria were developed to design a retrieval service for the city of Ibagué based on the information collected in this case study. The criteria are the result of the first stage of the research. Further work with the actors and similar fieldwork with other actors in other areas of the city must also be conducted to validate this activity.

The first criterion is that of image. On it, the aesthetic function of the services or products is seen as a tool to enhance the relations between the generators and retrievers. This criterion considers both the importance of the image as a 'door opener' with the generators, but also as a tool to empower the retrievers. The criterion also includes the symbolic function of design and must consider what this image represents for the individual retriever, the generators, and the other retrievers.

The second criterion is that of *performance*, in which the operational needs of the retriever are considered. In this criterion, the practical functions (efficiency, quality, and quantity) must be considered, along with economic functions (profitability of the labor, costs per type of material) of the entire system. This criterion also includes consideration of the practical functions of the subprocesses of retrieving in Ibagué as a way to achieve dignified conditions for the labor.

Third, the design must enhance the link between the generators and retrievers, leading to a criterion of *link*. This criterion must consider the way in which the generators sort and deliver the recyclable wastes; thus, the functional particularities of such practices have to be specifically designed (how the generator should sort), along with the symbolic (what this practice represents in the waste management chain), and the indicative (how the practice can make its functioning evident for the actors) functions. Designing ways in which 'loyalty' can be formed between a generator and a retriever should also be considered in this criterion. The most important aim of this is to enable generators and retrievers to relate in a different and closer way, in which the retriever is socially empowered through understanding of themselves as a social actor who develops a service with benefits for the entire community.

However, the link must also be understood as the role of design in linking other aspects that are broken in the actual practice. This criterion highlights the importance of linking the retrieval service with the rest of the recycling chain (this link could redesign the entire waste management service), as well as linking the retrievers with other services and social possibilities (education, health, etc.)

The fourth criterion is that of *knowledge*, which is related to the generator. It is important that the service is designed in relation to its sustainability over time, using strategies that allow the generator to be trained in source sorting and educated on the environmental and social benefits of recycling. In this sense, the practical (how the training will be developed inside the service), indicative (how the information will be made evident), and symbolic (how the benefits for all the actors will be made evident) functions, must also be considered.

A very interesting possibility to consolidate this criterion is opened through the rare cases of mutually supporting connections between generators and retrievers, as described above.

These connections change the social relationships between these actors and transform the retriever into a trainer; that is, one who teaches the generator how to sort, what to sort, how the waste management chain works, and the importance of waste management. In this way, training retrievers in service provision is essential. This training must consider practical functions (how the functionality of the service could be optimized) and symbolic (how the role of the retriever can be transformed and what the personal and social consequences of this would be).

The fifth and final criterion to be considered when designing waste retrieval services in Ibagué is *motivation*. The service to be designed must take into account time management, such that the labor is not overwhelming, and does not prevent the development of other aspects of everyday life, including entertainment, education, and family. This refers to practical functions (how the service considers time in the workday) and symbolic functions (what the time of service means for the retriever). In the same way, the service must allow for variety in processes (practical functions) so it will not be considered as a tedious routine for either the generator or the retriever. Moreover, the service must encourage the consolidation of social communities, thereby enhancing self-esteem and identity. If both actors find what they do in the service as meaningful beyond the economic benefits, then the service will be successful in terms of social sustainability.

These five criteria, the results, and all the information gathered and shared in this paper conclude the first stage of our research. The following stages require evaluating stage one, and design, prototyping, testing, and examining potential applications in other geographical areas. Finally, we suggest that in order to understand and deal with the complexity of the problematic situation described, research should center on the actors involved, from a multidisciplinary and systemic perspective.

## Notes

1. The term 'retriever' is used in this document to describe the population in Ibagué whose main source of income is from selling recyclable materials found in the rubbish bags of others. Other possible names for this population are 'waste pickers' or 'recyclers' (WIEGO 2009), but as they do not 'pick,' but rather search for the materials in the bags, and as they do not directly recycle the materials, 'retrievers,' which denotes searching and recovering, is deemed the appropriate term.
2. This discrimination comes from the cars on the streets where the bags are disposed, discrimination by generators and other social actors, and potential fights with other retrievers for the materials recovered or from the wastes among which are the materials they need. The diversity and level of these risks is important to consider.
3. *Chatarrerías* are the third chain link after generators and retrievers in the waste management chain in Ibagué. Their role is to receive the waste retrieved, store it by type until they have a suitable amount for sale, and finally sell the waste to the next link; that is, the producers who use the waste as resources for industrial products.
4. This workplace could be a public park, a street corner, or a public bench.
5. Except for cities such as Medellín, Bogotá, Cali, and Bucaramanga, which have developed their waste management systems and have made the waste sorting obligatory.
6. This employer is usually the security guard of the building or the 'general services' employer.
7. These informal collection points tend to be located on the pedestrian pathway and in front of an abandoned building, a vacant lot, a public park, or the corner of the house close to where their building is located.
8. In Colombia, the type of waste including food packaging, broken or damaged things, food waste and others are normally mixed by generators on the same bin. As these wastes are

generated and mixed on a regular basis, are classified as ordinarios meaning "ordinary" wastes by the National Institute of Technical Norms (ICONTEC).

9. Here, 'mixed' means that the suburb has both commercial and residential activities developed on it and approved by the city's planned land use.
10. This is also one of the main reasons why some generators did not sort, and for their 'distant' relationship with the retrievers.
11. We understand an actor to be a person or group of persons who are involved in a problematic social situation and are either affected by or benefit from it, or have interests in and the means to change it. This is in accordance with Aldana and Reyes's (2000) book *Dissolving Problems*.
12. These three quotes are comments collected from the interviewed generators' description of what retrievers were to them.
13. Waste bags in Ibagué are normally disposed of on the streets of the suburbs; thus, collecting and transporting them means being close to passing cars. Accidents of this type were not reported in the suburb, but the fieldwork showed that cars are a risk for retrievers.
14. Such animals include those interested in the waste, such as rodents, cats, and dogs. There is also a significant risk pertaining to insects such as mosquitoes, due to the high risk of dengue and *chinkunguña* in the region.
15. These are some of the descriptions used by the generators in the surveys when asked about the retrievers.
16. Two cases were reported to the authors in which the associated retrievers were even hurt by other retrievers for this differentiation.
17. This is a Colombian colloquial expression referring to earnings not being representative of the amount of work done.

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