

# A proposal for a method of the redesign of self-organising systems: The case of minibus transportation in the Istanbul public transport system

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## ABSTRACT

The aim of this study was to propose a method for situations in which self-organising systems developed by creative communities are considered by the governing authorities. Self-organising systems form as a result of situations in which the basic needs of communities are inadequately met by the governing authorities. In the framework of this study, minibus transportation, a system organised by community stakeholders, was addressed as a design problem, and a redesign of the system was proposed to the governing authorities of the public transport service of Istanbul. Semi-ethnographic research was used to investigate the case study, and service design tools were used to transform the information obtained into data that was presented to the designers. The methodology consisted of three research stages: recognise the self-organising system, perform research concerning the co-experiences of system stakeholders, and determine design references for the governing authorities. As a result of the study, design references obtained by applying the proposed methodology were converted and evaluated by the designers as design solution proposals.

**Keywords:** self-organising systems, creative communities, transition design, co-experience.

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## Introduction

The motivation for this work was to examine what constitutes the limited services formed by community stakeholders in situations where community needs are either not met or are inadequately met by the governing authorities. When the basic needs (education, transportation, health, security, nutrition, etc.) of a segment of society cannot be met for various reasons by the structures defined as governing authorities (municipalities, corporations, non-governmental organisations, etc.), local solutions develop and certain methods (to be under supervision, to provide economic control, to increase the quality of service, etc.) are suggested for reconsideration by these entities.

These local solutions allow actors in the community to find new ways to solve problems in their daily lives. For situations in which these solutions are recurred, the

definition of local needs and the understanding of social connections can create socially innovative approaches within the framework of product and service design (Meroni, 2007; Mortati and Villari, 2014). In order to identify systems that conform to this model and to understand the knowledge that system stakeholders have created, the designation "self-developing systems" has been employed. These systems, developed by non-professionals and re-addressed by professionals, constitute what Rittel and Webber (1973) call "wicked problems".

When self-organizing systems are evaluated on the basis of autonomy vision, we see that community practices the design of itself (Escobar, 2004). The key to autonomy is that a living system finds its way into the next moment by acting appropriately out of its own recourse. When we look at the self-organizing systems in this context, solutions are created by community stakeholders for basic needs of community. So, this approach is consistent with Escobar's

autonomy definition in the case of communities produces the norms by which they lived their lives largely endogenously (Escobar, 2004).

In the framework of the study, the concept of sustainability is defined as the viability of the local knowledge that the self-organising system stakeholders have developed. It is the main approach to studying how governing authorities understand and implement local viable solutions provided by self-organising system stakeholders. In this evolution of local approaches, the approach tailored to self-organising systems has benefited from the social innovation and service design literature discussed in this study (Morelli, 2011; Manzini, 2014, 2013; Irwin, 2011; Meroni, 2010; Joly *et al.*, 2014). Self-organising systems in the context of this literature are systems implemented within the societies that have not received adequately serviced by creative communities which are defined as communities that invent, develop, and manage sustainable new solutions that allow members of a society to live together.

### Self-organising systems in the framework of creative communities

When discussing self-organising systems, it is necessary to evaluate them in the context of creative communities. Douglass (2016) defined creative communities as a combination of a complex of community-space relationships that develop from the field of local creativity and new, original, and appropriate processes. Meroni (2007) has stated that they are communities that invent, develop and manage new solutions that are sustainable for the community. The common characteristics of creative communities are to keep life cycles in the same system, to keep individuals rooted in the places they live, to use local resources efficiently, to be strong in communication and interaction among themselves and to find solutions to local problems. The members of these communities are motivated by common denominators. This motivation, directly or indirectly, enables the formation of new ways of social change and development (Irwin, 2015).

Self-organising systems in the context of a creative society are defined as solutions that are carried out independent from the governing authorities of communities that have not received enough services. Where the needs of communities are inadequately met or not met by the governing authorities, the limited nature of service approaches by stakeholders is the main feature of these systems. Self-organising systems along with creative communities will refer to the service fictions developed by the society to solve their problems and to the product groups used in the frame of the system within these services.

Generally, when creative societies are evaluated, they are observed to be on the axis of developing countries (Marras and Bala, 2007). Solutions for the unmet needs of developing communities are described by creative communities, and such approaches are found in many countries with a large middle class (Marras and Bala, 2007). In this context, self-organising systems are defined as solutions provided by creative communities independent of the governing authorities. The main difference the approaches developed by social innovation approaches that come from

triggering innovative approaches from local to local (from the centre to the end) (Manzini, 2014).

Rittel and Webber (1973) argued that due to their nature, social policies are condemned to failure when faced with such problems. The "tame" of such structures also creates a problem from a political point of view. One of the main reasons for this is that public services have been designed by professionals so that government programs address the problems and wants of those who will receive services in certain standards. However, to address certain types of problems, non-professional sources of movement (local stakeholders) re-interpret the tasks that must be carried out by professionals (Rittel and Webber, 1973). These self-organising systems are constituted by the initiative of the local community, and, as they differ both structurally and functionally from municipal or governmental systems, they are not suited to the governance mechanisms of these entities. The problems they address fall under the definition of "wicked problems".

### Case study: The minibuses in Istanbul's public transportation system

In developing countries, public transport cannot handle the growing demands. There is a widening gap between what is expected of public transport and what can be delivered (Toker, 2012). In Turkey this problem was solved with a paratransit system which is called Minibus – Dolmuş. Especially in Istanbul which is greater than the rate of development of the city's population growth rate compared to other cities in Turkey, it is observed that the higher rate of transportation construction used (Ekmekçioğlu, 2017). Therefore, one of the most instructive example that can be given of a system organised by community stakeholders today is the use of the minibus in the public transport system of Istanbul. This study involves the participation of the local stakeholders in the context of the city's local transportation system. The minibus system in Istanbul aims at establishing a connection to the city centre for the people who live in areas on the outer periphery of the city who cannot access the primary transportation service. These minibuses began in Istanbul and were later adopted in other places, the local stakeholders of many localities with



Figure 1. Minibuses in Istanbul's public transportation system.

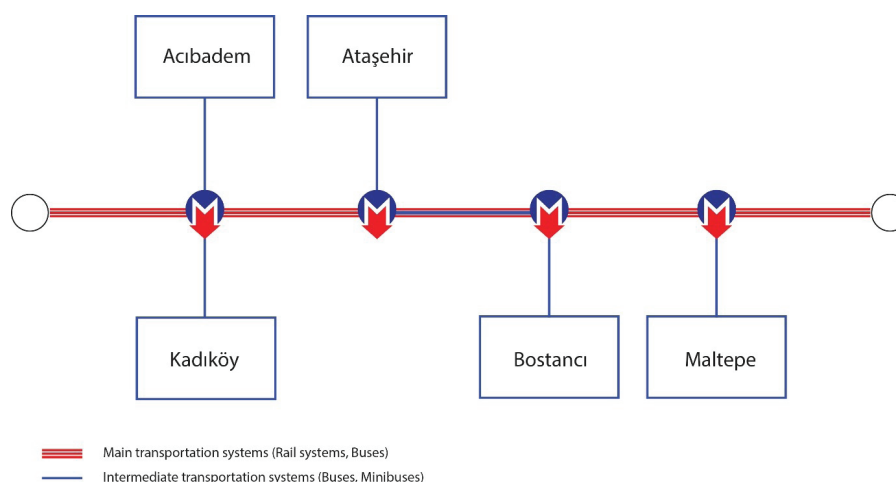


Figure 2. Istanbul Metropolitan Municipality transportation plan for minibus lines.

transportation problems adapted this system (Şanlı, 1981). The minibus system is especially suited to our society, with an urban life both culturally and functionally a little “awake”, a certain kind of life that contains a little bit of corruption (Tekeli and Okyay, 1981). Due to its position and function in today’s public transportation systems, this service has been requested to be renewed by the upper organisation municipalities (Ekmekçioğlu, 2017).

When the minibus system is assessed in the context of Istanbul, it is desired to be redesigned by the Istanbul Metropolitan Municipality (IMM) and redesigned with contact points in order to suit modern transportation habits, transportation systems and plans (Ekmekçioğlu, 2017). The system provides a solution to many aspects of transportation problems in the regions where it is used. However, the municipality has many limitations in relation to the product and service in terms of the transportation service and the expectation of service use of the passengers. The IMM has dealt with many solution proposals that concern both renovating the minibus system and integrating it with other transportation systems (UKOME, 2014). However, these proposals have not been effectively put into practice in the field (Ekmekçioğlu, 2017). This suggests that the solution proposed by the governing authorities is not acceptable to the system stakeholders. The possible reasons for this include the failure of the governing authorities to understand the complex structure of the minibus system, a local system organised by local stakeholders, and that information generated by the local stakeholders is not included in the new solution proposals, making the new solutions part of an unsustainable structure.

### Investigation of self-organising systems: Key stakeholders and co-experiences

As a result of social innovation approaches, creative communities and design associations are shifting from a product centre to a service-based product-service centre (Meroni, 2010). This is primarily due to the fact that ways to solve everyday problems are formed by social networking, shaped by the relationships of local stakeholders to

address needs and to provide goods, services and information exchange (Joly *et al.*, 2014). Contrary to the co-design processes observed in social innovation and service design approaches, solutions are created by community stakeholders in self-organising systems. Instead of co-creation, a method should be developed to make use of the previously proposed product and service experiences within the newly proposed design process and to include this past information in the system. In this case, incorporating the information obtained by system stakeholders in their shared experience of the previous system will lead to the creation of sustainable solutions for both system stakeholders and for the governing authority.

It is necessary to define the concept of the stakeholder within a self-organising system before stakeholders can be identified. Miettinen (2011) stated that, in the context of the co-creation process, all stakeholders should be included in the service design process. The activities of stakeholders in a system can be used as important data for product and service development processes. With these approaches, the stakeholders involved in the design process can be regarded as both solution makers and users. When we look at stakeholders in the framework of social innovation using service design approaches, complex structures and ecosystems are seen (Akama, 2009). These elements create a complex relationship among stakeholders (Akama, 2009). When assessed in the context of social innovation, complex interest networks among stakeholders pose many challenges in understanding or designing systems in practice (Yang and Sung, 2016).

When we identify system stakeholders in the context of self-organising systems, we encounter social actors. In the context of creative communities that have not been adequately serviced within the framework of a system, the social connections and associations of local stakeholders become very important (Joly *et al.*, 2014). Local actors organize systems through these relationships and produce alternatives for inadequate services. These social relationships motivate actors to solve socialized needs. There is a fundamental difference between the contribution to the design process of stakeholder events in self-organising

systems and other design approaches. In the systems that organize themselves in the manner of the minibus system of Istanbul, the solutions have been realized by the stakeholders. There is no upper organisation or designer intervention in these solutions. After the system is created, the governing authorities are added to the system as stakeholders for various reasons.

This kind of organisation ensures that the contribution of stakeholders who play a major role in the operation of the system is important. Within the scope of the study, these stakeholders will be defined as key stakeholders. Identifying the interaction of key stakeholders with each other will provide an understanding of the system. To understand these relationships, the common experiences of key stakeholders should be evaluated. The concept of common experience was first introduced by Battarbee and Koskinen (2005), since user experience studies do not reflect social skills became from social connections. A co-experience is one in which the user experience is the result of the social context (Lee, 2009). This leads to the formation and interaction of structures that involve social communities rather than singular individuals.

Co-experiences are formed and shared under certain circumstances by individuals within a community. For this reason, the formation and interaction of structures that involve social communities rather than individuals are important. In a common experience, creativity comes to the forefront in the way people interact with one another in their daily lives (Battarbee, 2003). In this context, creativity is nothing more than an act carried out by the designer, while the stakeholders create their own solutions through social interaction. The joint experience of self-organising system stakeholders generates observable information. Sanders (2002) states that experiences cannot be designed, that experience is within people, and that this can be interpreted through observation. Within the context of the social sciences, understanding people's experiences by various methods and achieving accessible knowledge can be key for learning understanding people's experiences

can help make sense of events, thus allowing for effective design (Buchanan, 1992). Stakeholders solving a problem that they identify in the social environment through social interactions create common experiences in the context of the system. These experiences also include system knowledge. Use of this information by the governing authorities can lead to the creation of sustainable solutions in the context of self-organising systems.

## Methodology

The study aims to investigate a self-organising system in depth by observing the information created by the stakeholders and to use this knowledge in the new design process to be carried out by the governing authority. When this proposal was developed, two sources served as the basis for this study. The first was past researches on creative communities and social innovation. The second was the evaluation of the minibuses of Istanbul as a self-organising system, as well as the involvement of the governing authority in this system. Also, two basic inputs for the method emerged: the information that system stakeholders produce and the conditions under which governing authorities may redesign the system. The information that stakeholders produce will be examined within the framework of the common experiences of key stakeholders.

This study employs a semi-ethnographic methodology. This is a qualitative approach used in research concerning creative community approaches and social innovation (Meroni, 2007; Cipolla, 2012; Manzini, 2009; Morelli, 2011; Yang and Sung, 2016). Ethnographic research was used to investigate the case study addressed by this paper, and service design tools were used to transform the obtained information into the data to be presented to the designers. In addition, social research methods were utilized (Neuman, 2006; Punch, 2014). The current research consists of three stages and seven sub-stages (Figure 3).

First stage of research includes recognize the self-organizing system. It is necessary to understand why the

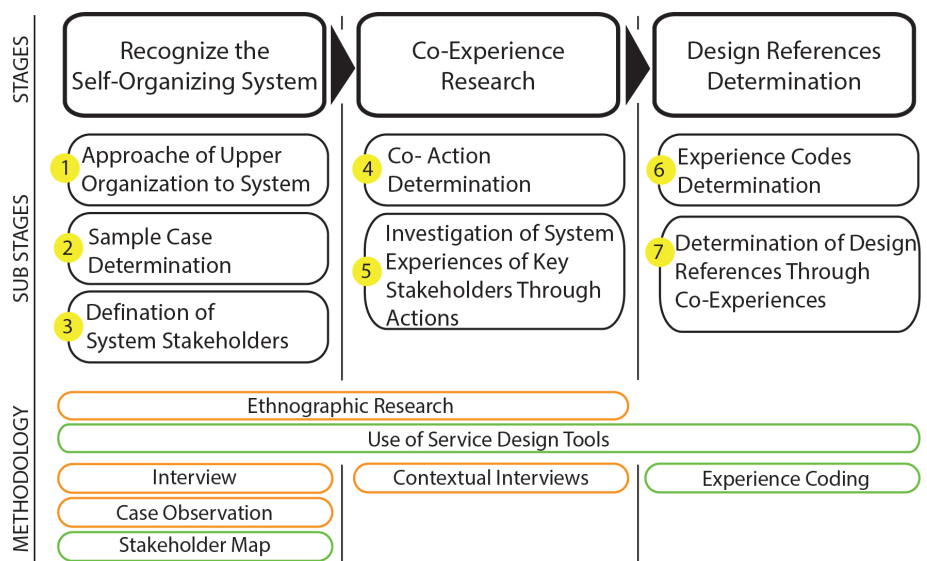


Figure 3. Research stages and methodology.

governing authority wants to address self-organizing systems before starting the research. As a result of the interview work, it emerged that the governing authority wanted to redesign the self-organising system and the future plans for this system were developed. In the second substage of recognize the system, a sample case should be determined for investigated in depth the self-organizing system. After case determination system stakeholders and key stakeholders must defined. For recognize the self-organizing systems interview studies, observation studies and stakeholder mapping studies were conducted. Service design tools were used to analyse the interactions described by the stakeholder map among the service, the cooperative organisations related to the service and other stakeholders.

Second stage of research includes co-experience research of key stakeholders. This stage consists of two substages. In the first substages, co-actions of key stakeholders must determinate with observational study. The purpose of the observational study was to investigate how the system stakeholders interact with the system and each other. Observation work carried out on the minibus system was unstructured. The aim was to observe the natural state of stakeholder actions and system operation and ensure that no intervention by the investigator occurred. In the second substage of co-experience research key stakeholders' system experiences must investigate through their actions. In this phase, contextual interviews with key stakeholders were conducted and the data recorded. Negotiations made in the framework of work are called 'structured negotiations'. The main purpose of the interviews was to obtain clear and unambiguous information on the topic, which was obtained with very little variation in answers despite the use of open-ended questions. Research into systems requires contributions from the organisations that supervise them.

Third stage of research is defined design references for the governing authority. In the first phase of this stage is determination of experience codes of key stakeholders. Contextual interviews were used to identify key stakeholders in the system and to analyse the experiences of these stakeholders. The information gained from the stakeholders was coded into design references. In the second phase of third stage, experience codes refer to design references. Experiential coding was also performed on common experiences to transform key stakeholders' experiences into design referrals.

### Application of the method to the minibus in Istanbul's public transportation system

This section describes the implementation of the proposed method of the reconsideration of a self-organising system by governing authority. The case study was the minibus system within Istanbul's public transportation system. The IMM Public Transportation Services Directorate (IMMPTSD) is defined as the governing authority in this context. In addition to providing co-experience of minibus system stakeholders in the framework of the proposed method with other data such as stakeholder data, IMMPTSD data and minibus data search will be obtained from the system.

## Recognize the self-organising system

The analysis of the self-organizing system under study occurred in three stages. First, the governing authority reconsidered and investigated future plans for the system. Then, after the self-organising system was observed, the system stakeholders were determined and the relations among them were revealed.

## The approach of governing authority to the self-organising system

An interview was conducted with to understand how minibus system was assessed by the IMM and how it was positioned for the future. According to the IMMPTSD, because of urbanization, the areas where the transportation services are insufficient are where the unofficial structures that provide transportation to the urban centre occur. Since the minibus system not directly under the control of the Directorate, it provides a convenient means of transportation. This provides advantageous possibilities for both operators and passengers, making it an alternative option for reaching many points in the city centre from the outer periphery of the city.

The IMMPTSD has presented many plans of minibus and public transport systems (Ekmekçioğlu, 2017). The increase in the number of rail systems and investment in other transport systems has reduced demand for minibuses in public transportation. Compared to other public transportation plans on the same routes, minibus lines have undefined and independent structures. This has caused the minibus system to be transformed into an idle system. In this context, the municipality has set the following objectives for the future of public transport with the minibus:

- To integrate the minibus system with all public transport systems and to give an identity to minibus transportation.
- To ensure the integration of city transport plans and to re-plan this system in accordance with other systems in Istanbul, where 28 million trips on public transportation are taken daily.

In this context, the plan is that the system will be transformed into a transportation alternative for limited areas while the transportation authority determines the long-range function of the minibus. Modern cities tend to group transportation into two systems: main and intermediate. While the main transport system in Istanbul is generally rail, wheel transport systems, such as minibuses and buses, are intermediate. This shows that the structural characteristics of buses and minibuses help to determine their roles in the transport system. In this context, the places the municipality considers suitable for public transport by minibuses possess the following characteristics:

- Socially and economically differentiated regions.
- Locations where the passenger volume is low and the route can be completed quickly.
- Regions where geographical constraints exist that present difficulties in the integration of other public transport systems.
- Specialized areas.

## Sample case determination

The choice of the Rasathane – Üsküdar line as the subject of this study was suggested by the IMMPTSD, which sees the minibus, a form of transportation that serves as a transit system connecting the main transport systems and the neighbourhoods, as a suitable feature for this area. Within this study co-experience coding work was done.

In studies of self-organising systems, ethnomethodological observation methods are utilized in field observations. Such observations are predominantly based on verbal and visual behaviour, examining both the presenters and their daily interactions (Punch, 2014). Video observation, video recording, and shooting tools were used. The recording ensures that the data can be examined in detail and then resolved. The video recording tool was positioned to examine in detail the operations performed by passenger and driver stakeholders from various angles in and around the minibuses. The minibus route was also observed while the minibus was in motion. Data on the operation of self-organized system could not be provided. Observation work was performed both within IMMPTSD and the minibus line. Recording occurred 12 times for a total of 6 hours: 4 times at the driver's location, 4 times at the passengers' location, and 4 times at the minibus. Later, in the contextual interviews, video analysis was done to enable the designers to interpret the system so that the system's key stakeholders and design solutions could be determined.

A set of images was created in which the basic actions of the involved employees could easily be perceived, interpreted and assessed by the focus group. The analysis was carried out within the framework of the joint actions identified at the end of the observational studies. Critical points and markers of the system, according to the chronological order of common actions, points and markers were prepared for each action (<https://vimeo.com/228791474>, password: 1234).

## Definitions of key system stakeholders

Miettinen (2011) identified the stakeholder map as a good way to identify stakeholder relationships and the issues that arise within them. Creating a stakeholder map ensures that groups of people based on their interests are seen and that service providers can better analyse resources in response to problems. Maps provide visual data for the observation and detection of complex situations involving system actors. Stakeholder maps in the context of self-organising systems are beneficial in the resolution and reading of complex social relationships.

Mapping between stakeholders can be achieved by means of interviews with members of the responsible organisations, as well as elaboration of the interactions between stakeholders. Key stakeholders and other stakeholders in self-organising systems should be distinguished while the stakeholder map is being created. It is important to chart the interaction of key stakeholders at the centre of the system with each other and with other stakeholders. The map describes the direction, form and quality of the interaction between stakeholders.

As a result of observation and interviews, the key stakeholders and other stakeholders of the system were identified and the stakeholder map in Figure 3 was established. 'Passenger', 'minibus (driver, line)' and 'municipality' were identified as key stakeholders for the minibus system. The common feature of key stakeholders is that they are responsible for the organisation of the minibus system. Government, stewards, minibus chambers, İSPARK (the Istanbul Parking Operations Company), traffic control and minibus producers were identified as other stakeholders. Although they are located at the centre of the self-organising minibus system, the passengers, who do not encounter the municipality constitute the stakeholder group which interacts least with other stakeholders. Interaction with all key stakeholders is realized only by the driver and the line. This interaction is more complex than the usual passenger-driver interaction.

The communication between the passenger and the minibus driver/line derives from the way minibuses operate. Dialogue between these two stakeholders is very effective in shaping the system. The biggest difference between the minibus and the standard public transportation system is that the minibus is a solution that the passengers and drivers co-operatively arrived at based on common interests. The minibus is a form of transportation which can be easily adapted to the passengers' wishes and provides benefits to people who for the first time find themselves organised into a constituency. The preservation of this structure is the result of the wishes and interventions of the passengers. This leads to the formation of an undefined system of interests between the minibus driver and the passenger.

In the definition of the minibus, there are two overlapping structures. These are the lines or routes that the drivers work and the drivers themselves. These can be evaluated as an individual artisan model, organising and building with other minibuses working on a certain route. Minibus drivers must comply with various non-written rules on the lines they drive. A minibus line consists of the line chairman, vice chairman and driver, and works from a minibus

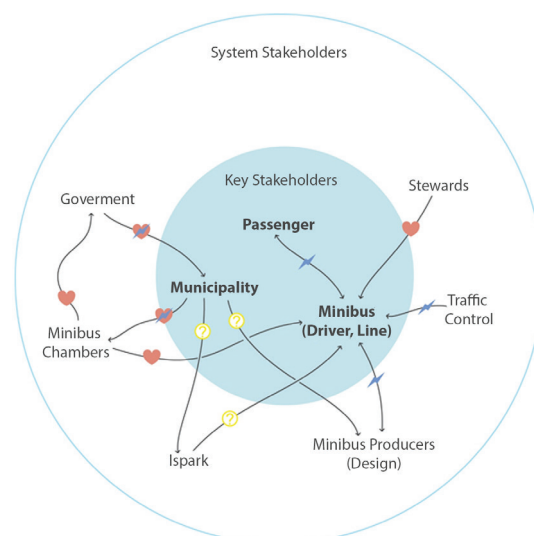


Figure 4. Minibus system stakeholder map.

chamber. The chairman of the line is chosen among the minibus drivers who work on that line. The line chairman is responsible for ensuring the regular operation of the system and the minibus rooms.

The minibus stakeholder, unlike the passengers, is in very close interaction with other stakeholders of the system, and is among the foundations of this interaction structure, being organised and having control over system management. Minibuses, passengers, the municipality, traffic control, the minibus producers, ISPAK and minibus rooms are in various levels of interaction. Along with the existing service concept in context of self-organizing, minibus drivers are the interfaces of the service system. They are the stakeholders from whom passengers can gather information and to whom they pay fees or express a wish to ride a minibus; drivers gather at the centre of many actions.

Municipality is the stakeholder which wants to restructure and control the self-organising minibus system by assuming it into the upper organisation. The municipality, whose inadequate system of public transportation produces the need for the minibuses, now wants to be in the position of supervising and planning the minibus system. The municipality plans to continue with the minibus rooms and minibus producers. There is little communication between the municipality and passengers, however. The system requirements like schedules, type of vehicles is determined in the minibus rooms. Passenger decisions are based on experience and other transportation systems schedule information's (buses, rail systems, etc.). The municipality sets the standards for the transport system. These standards relate both to the minibuses to be used in the system and its service. However, municipalities do not have any mechanism to control minibus lines in the area. This situation keeps the system's function and service quality outside of the control of the municipality, although it wants to regulate the minibus lines.

### Determination of common experiences of key system stakeholders

The joint experience of key system stakeholders is determined in three steps. The joint actions of the stakeholders are defined through observation. Then systematic interviews with key stakeholders concerning joint actions are conducted. After the experiences of the stakeholders are identified, these experiences are coded and common experiences are determined.

### Determination of co-actions

In the determination of the actions, the observation work on the Rasathane – Üsküdar minibus line was shared with the municipality and joint actions affecting all key stakeholders were identified. The eight joint actions are chronologically as follows:

- Decide to use public transport with a minibus.
- Wait for or catch a minibus.
- The minibus rides.
- Be informed about transportation in public transport by minibus (fee, schedule, route, etc).
- Pay the fee.

- Travel on the minibus.
- Indicate the place to land during the journey.
- Descend from the minibus.

The importance of these actions to key stakeholders will be explained in turn. With the results of the experience survey, the joint experience of the key stakeholders can be observed.

### Coding co-experiences

The experiences of the key stakeholders were explored through joint actions identified within the context of interviews concerning minibus and public transport system observation. The video prepared during the observation study was shown to participants, who were asked to identify positive and negative experiences of the eight actions through an open-ended questionnaire. Thirty-five passengers using the Rasathane-Üsküdar line, 10 minibus drivers working on that line and 5 experts working in the Transportation Development Department of the IMMPTSD participated in the study.

Within the framework of the methodology, observation studies from field surveys and interpretations of findings were provided to the focus groups of system stakeholders. This enabled the behaviour of the key stakeholders to be interpreted by these stakeholders and their experiences within the system to emerge. Video footage from the observation surveys was the primary source of experience research. Key stakeholders were requested to interpret the joint actions in the context of the footage. In their comments, these key stakeholders noted positive and negative experiences corresponding to each action.

There were different contextual interviews for the three key stakeholders (passenger, minibus driver, municipality) in the minibus system. The 35 passengers who used the Rasathane – Üsküdar line were asked to respond to the interview questions by interpreting the video data. The work done with the municipality was carried out with a focus group affiliated with the IMMPTSD. The work carried out with minibus drivers was conducted during the minibus expedition.

The co-experiences of the system key stakeholders were obtained by analysing their responses to the video footage; the same or similar experiences were considered co-experiences. This assessment considers the same positive or negative experiences that result from the key stakeholders experiencing the minibus system under different conditions. This work is defined as experience coding.

Experience coding is the analysis of the key stakeholders' experiences within the system. Coding was performed upon qualitative data, which is a social research method (Neuman, 2006). Coding exercises were carried out in three stages ('open coding', 'axial coding' and 'selective coding') (Punch, 2014). These stages will form code titles and design references. Explicit coding is the first encoding of qualitative data; it examines exploratory data and summarizes them in preparation for analytical categories or codes. The goal of open encoding is to get the surfaces out of the depths of the data. Clear coding work has been done for each key stakeholder through the output of the contextual

**Table 1.** Co-experience coding of key stakeholders.

Actions	Positive experiences	Negative experiences
Decide to use public transport with a minibus	Fast Use in areas where public transport is not available	-
Wait for or catch a minibus	-	Minibuses can be stopped anywhere
The minibus rides	Small vehicle, serial riding	Crowded minibuses
Be informed about transportation in public transport by minibus (fee, schedule, route, etc)	-	Passenger-driver dialogue
Pay the fee	-	Money exchange
Travel on the minibus	Practical	Quality of vehicles
Indicate the place to land during the journey	Formation of different intermediate stops of the bus stops	Disputes between driver and passenger
Descend from the minibus	-	Stopping the vehicle in unsuitable locations

interview. It is kind of a 'brainstorm' coding operation and provides the first set of information. The open coding practice made it possible to separate experiences in a positive and negative way. In addition, groups were created under the themes based on these expressions. Axial encoding is the second phase of coding the qualitative data; during this stage, the researcher edits codes, constructs connections and discovers the basic analytic categories. Concepts represented during open coding are organised in axis coding to form preconceptions. Ideas and themes are organised and analysed. Selective coding is the last phase in the coding of qualitative data. The investigator examines previous codes to determine and select data to support the conceptual coding categories that have been developed. Codes are set up to create top headings (Table 1). In the experience coding operation, the codes obtained by the selective coding form the headers of the design references. Headings created by axial encoding include detailed information about the references under the headings.

The coding of the output allows designers to implement their analysis. By analysing the joint experiences described by this data, system stakeholders' experiences observed. These data were combined with experience codes in two different tables: positive and negative common experiences.

### Determination of design references

In the case of Istanbul minibuses system being reconsidered by municipality, the design references for the new system were created by means of the axial encoding of the common experiences of the key system stakeholders. The co-experiences of passengers, drivers and municipal stakeholders identified as key stakeholders within the case study are taken as references. References are grouped under the title of positive and negative design references. These groupings allow for the identification of the problems that have been addressed by the self-organising system and those that have yet to be solved, as well as for the creation of an information set that can be used in the redesign of the system.

### Criteria to be referenced from the self-organising system

Criteria to be referenced from the self-organising system are based on the positive and negative common experiences of the key stakeholders. The identification codes are divided into positive and negative. The axis codes obtained from the analysis of the data form the design references. The positive and negative design references for the minibus system are given in Table 2 and Table 3.

### Evaluation of design references by designers

The results of the research on the minibus system were provided to the designers and design solutions were obtained. The designers were given the following categories of data derived from the study: "Self-Organising System Data", "Governing Authorities Data", "Experience Codes" and "Design References". The video and the stakeholder map created as a result of observation are self-organising system data, while the aims and future plans determined for the system by the upper organisation are upper organisation data. Experience codes and design criteria were both used by designers.

The result of the proposed design methods for self-organising systems was the development of design solutions that combined the use of joint experience data with other data. For the purpose of the work, it was determined that the information obtained from the self-organising system should be used in the design process together with the shared experience of system key stakeholders.

Six industrial designers and a city district planner participated in the study. The designers suggested a total of seven design solutions (Table 4). When the design analysis in the social innovation and transformation design literature is examined, three different design approaches are observed: product design, service design, and product-service design (Meroni, 2007; Manzini, 2014; Morelli, 2011). The design solutions realized in this study occur within these three categories. It was determined that



Table 2. Positive design references.

Positive experience code	Positive design references
Fast	<ul style="list-style-type: none"> <li>- Preferable when time is limited</li> <li>- Getting to the destination cheaply and quickly</li> <li>- Short service intervals, reachable</li> </ul>
Use in areas where public transport is not available	<ul style="list-style-type: none"> <li>- Routes pass through more settlements</li> <li>- The first planned transport system for the newly built settlement centres</li> <li>- Transition to permanent transportation system for small settlement systems</li> </ul>
Small vehicle, serial riding	<ul style="list-style-type: none"> <li>- Practical public transport service with small vehicles</li> <li>- Easy ride up and down</li> <li>- In-car information sharing due to structure</li> <li>- Use of alternative routes in the case of traffic</li> <li>- Smaller cost for short distances</li> </ul>
Formation of intermediate stops	<ul style="list-style-type: none"> <li>- Can be ridden to the desired place</li> <li>- The formation of stops close to the areas where the tracks are used</li> <li>- Do not have to walk to the bus stop</li> <li>- To be able to get off the vehicle at a closer location to the desired location</li> </ul>

Table 3. Negative design references.

Negative experience code	Negative design references
Minibuses can be stopped anywhere	<ul style="list-style-type: none"> <li>- Stops to deposit passengers in places where vehicles are not suitable for traffic</li> <li>- Traffic problems in traffic-intensive areas</li> <li>- Creation of waiting points in places where vehicles are not available for stopping</li> <li>- Passenger loading and unloading</li> <li>- Points the passengers want to land change according to the traffic rules and vehicle availability</li> <li>- Passengers wanting to board or ride at short distance intervals</li> </ul>
Crowded minibuses	<ul style="list-style-type: none"> <li>- Traveling when the minibuses are overloaded</li> <li>- Passenger safety is low when traveling</li> <li>- Difficult access to the door to get down</li> <li>- Difficulty in getting rides by the disabled or children</li> <li>- The inability to see the outside of the vehicle and the location of the passengers</li> <li>- Uncertain passenger capacity of vehicles</li> </ul>
Passenger-driver dialogue	<ul style="list-style-type: none"> <li>- The obligation to contact the driver to pay the fare or to provide information</li> <li>- Difficulty of communicating with the driver of a full minibus</li> </ul>
Money exchange	<ul style="list-style-type: none"> <li>- The obligation to ask for a driver if there is no fixed fee or a fee dispute</li> <li>- The chauffeur is paying, giving money and doing these other things while at the same time driving.</li> <li>- No integration with other transportation systems as a result of not using electronic tickets</li> <li>- In case the passengers are on the road while traveling, payment of fees and security problems</li> </ul>
Quality of vehicles	<ul style="list-style-type: none"> <li>- Old and neglected vehicles</li> <li>- Newly designed vehicles are not preferred by minibus drives</li> <li>- Vehicles not suitable for handicapped use</li> </ul>

one of the three design approaches should be taken as a basis for the suggestions of the seven original solutions presented by the designers. Two participants suggested product design, two participants suggested product-service hybrid design and three participants suggested service design.

The proposed solutions for the minibus system are based on design approaches and are closely related with another. This can be explained by the fact that the shared experience data of the designers involved in the process were investigated by different researchers during the research phase, and the information embedded in certain templates was given to the designers. Designers made use of the same data repository arrived at similar solutions independently of each other.

When design suggestions are examined, it is observed that design references consisting of common experience

data are used efficiently. Experience codes and design references are included in more than one solution. Moreover, although the code sets used by the designers are similar to each other, both solution proposals and design approaches can be differentiated. There are two different explanations for this situation. The first, along with co-experience data, was used in other self-organizing system data. This situation differentiated the diversity and quality of the design suggestions. The second is that the personal opinions of the designers affect the design process as well as the self-organizing system data in design solutions. It was observed that the designers' personal experience of the system in the minibus case study was reflected in the solutions. This is inevitable for situations in which self-organizing systems are addressed. Because these solutions are realized in the local context, they reach the stakeholders in the urban scale.

Table 4. Design suggestions.

Designer	Design suggestions	Design approach
A	Minibus design	Product Design
B	Mapping work and telephone application design	Service Design
C	Minibus stall planning and design	Product – Service Design
D	Minibus tracking system and intermediate stop planning	Service Design
E	Minibus interior design	Product Design
F	Intermediate stop planning	Product – Service Design
G	Redesign of location of minibus in public transportation	Service Design

## Result

Self-organising systems have been defined in this study as solutions performed by creative communities that have not been adequately serviced. In cases where community needs are not met by the governing authorities, the solutions created to address the problems of local actors in their daily lives constitute the basis of self-organising systems. The main features of these systems have been described. They are organised in line with the social connections and relationships of stakeholders, alternatives to the design, service and management activities that have not been achieved, and are independent of the superstructures in the system. They perform their own product and service solutions in some way.

This study has investigated the co-experiences of key stakeholders, collected data on this closed system and used system information in the development of a new process. The main problem encountered while studying self-organising systems is that they are closed systems. They tend to hide themselves from the governing authorities, as is apparent in the minibus case study. Both this research and the failure of these systems to implement decisions made by the municipality demonstrate a clear need for self-organising systems to be under supervision. This creates a concern that the failure to work with the governing authority may arise from a reluctance among the stakeholders, who fear an audit, to share information. On the other hand, the researcher to determine how the governing authority would make changes to the system.

Self-organising systems have been identified within the study through examining the relationships and interactions of stakeholders. In order to analyse the resulting information, the common experiences of the key system stakeholders were investigated and used within the framework of the design process to be carried out by the higher organisations. There are two basic reasons for incorporating co-experiences in the search for information that arises in self-organising systems. The first is that the solutions realized within a self-organising system take place through the process of common creation by system stakeholders. The second is that self-organising systems are complex systems and that it is difficult to define social relations in such systems.

The solutions arrived at by the common creation processes of the stakeholders and realized within self-or-

ganising systems enable the stakeholders to experience different aspects of common situations. The ability to read these experiences on a common pie ensures that system information is correctly understood. As self-organising systems are complex and it is difficult to identify social relationships within them, the use of common experiences in the proposed design process was decided upon. Tracking co-experiences have been instrumental in ensuring that this system was correctly analysed.

During the work on the references in the redesign of this self-organising system, collaborative creation processes were utilised and design work was carried out with the participation of stakeholders. The method proposed in this study introduced some variation to the standard approach. In self-organising systems, system stakeholders have found a solution to an existing problem and implement it; they do this through the co-creation process. Governing organisations should reconsider these systems, taking into consideration the information generated by the stakeholders during the co-creation process. This would provide the indirect involvement of system stakeholders in designing new products and services within the proposed design process.

Many different approaches can be utilized within the framework of self-organising systems. When the case of the minibus within public transport was set out, the key stakeholders and their co-experiences were used in the context of what they were trying to make sense of this information and the results were meaningful. But for other case studies, different approaches could be constructed according to the nature of the self-organising system. Two basic inputs should come to the forefront in any kind of work concerning these systems. The first is the stakeholders that organize the system and make it exist, and the second is the information generated by the stakeholders during the creation and implementation of the system.

Under these circumstances, information resulting from the co-creation process can be interpreted and a product design and service proposal can be obtained by means of a participatory design process. Considering the minibus and the public transportation system as a case study has been a fundamental factor in the development of the design process proposed in the thesis. It is possible to implement direct participatory process recommendations for smaller-scale systems.

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