Transportation Research Part D 93 (2021) 102732

Contents lists available at ScienceDirect

Transportation Research Part D

journal homepage: www.elsevier.com/locate/trd

Assessing travel satisfaction in public transport: A configurational approach

Alexandre Sukhov [a], Katrin Lättman [a,*], Lars E. Olsson [a], Margareta Friman [a], Satoshi Fujii [b]

[a] CTF Service Research Center, Karlstad University, Karlstad SE-65188, Sweden
[b] Kyoto University, Katsura, Nishikyo-ku, Kyoto 615-8540, Japan

ARTICLE INFO

Keywords:
fsQCA
Intervention
Public transport
Service quality
Travel satisfaction

ABSTRACT

Previous findings have established that satisfaction with public transport service quality attributes (reliability/functionality, information, courtesy/simplicity, comfort, safety) relate to overall travel satisfaction. Recent studies propose that the importance of these attributes for travel satisfaction varies in different contexts and call for new approaches for enhancing the understanding of these relationships. We address this call by using a configurational perspective and applying fuzzy set Qualitative Comparative Analysis (fsQCA), to explore how satisfaction with service quality attributes relate to high travel satisfaction. By analyzing user survey data before and after an intervention in public transport services in a Swedish city, we: 1) find that high travel satisfaction occurs in the interaction between service quality attributes; 2) identify different configurations of satisfaction with service quality attributes leading to high travel satisfaction; and 3) show how context alters overall travel satisfaction. We conclude that using a configurational approach is useful for understanding the complexity of travel satisfaction.

1. Introduction

Using public transport for daily commute is an important element in many people's lives. Previous studies show that having high quality public transport services contribute to an improved overall travel satisfaction (Olsson et al., 2020), and that satisfaction with daily travel relate to the overall quality of life (Ettema et al., 2010). However, in order to manage high travel satisfaction in public transport there is a need for a better understanding of which external factors that are necessary and which are sufficient for creating high travel satisfaction for the users of the public transport services.

The dominant theory for assessing travel satisfaction is the utility-maximization theory (McFadden, 2001). According to this theory, satisfaction is equated with the perceived utility of the chosen (travel) alternative and, unlike decision utility, experienced utility focuses on how the traveler values the outcome of a choice. This outcome can relate to satisfaction during travel or satisfaction as remembered when recalling a specific trip or a specific mode. Previous research has acknowledged the dynamics of an experience, and thus aspects such as repeated experiences, past experiences, and interactions between experiences are recognized as means to take into consideration when capturing the viewpoint of the users in order to reach greater insight into their full experiences (e.g., Verhoef

* Corresponding author.
E-mail addresses: alexandre.sukhov@kau.se (A. Sukhov), katrin.lattman@kau.se (K. Lättman), lars.e.olsson@kau.se (L.E. Olsson), margareta.friman@kau.se (M. Friman), fujii@trans.kuciv.kyoto-u.ac.jp (S. Fujii).

https://doi.org/10.1016/j.trd.2021.102732

Available online 13 February 2021

et al., 2009).

Experienced utility is best captured using different types of self-assessment measures. In order to measure experienced utilities, the individuals usually estimate how "satisfied" or "dissatisfied" they are with the travel in general and/or with various quality attributes such as seat availability, air conditioning, or cleanliness. Reported self-assessments can then be analyzed in different ways depending on what specific questions that are asked. A common approach is the use of regression analysis, which shows how different variables (e.g., satisfaction with different quality attributes) affect an independent variable (e.g. overall travel satisfaction). In real life, however, the relationships between different variables can be quite complex and perhaps not as balanced as they often appear in a regression-based analysis (Woodside, 2013). As an example, let's say that high comfort has been shown to relate to a high level of travel satisfaction. Then imagine that the comfort of public transport for a specific area is experienced as unsatisfactory. Some travelers will still report high levels of travel satisfaction, which may be due to other service attributes, such as the payment-options available being satisfactorily reliable and easy to use. Other travelers may be satisfied with their travel due to the combination of satisfactory real time information and punctuality in departure and arrival times. In this fictive scenario, it is imaginable to conclude that a satisfactory level of comfort is not a necessary condition for high overall travel satisfaction even if it would be true for some travelers. Given the extensive research effort put into identifying determinants of travel satisfaction, and the likelihood that these determinants interact, it is surprising that only a handful of studies in public transport have explored combinations of different service quality attributes (i.e., configurations) that are associated with high overall satisfaction (e.g., Miranda et al., 2018).

Multiple studies have attempted to identify attributes of public transport services that increase user satisfaction (e.g., Friman and Fellesson, 2009, Hensher et al., 2010, De Oña and De Oña, 2015, De Oña et al., 2013, Susilo and Cats, 2014, Van Lierop et al., 2018, Susilo et al., 2015). Redman et al. (2013) conclude that, in public transport, there exists two types of quality attributes, namely: *perceived attributes* and *physical attributes.* Perceived attributes refer directly to usersś experiences of specific conditions. If, for instance, new information boards or improved air-conditioning are implemented in vehicles, this is commonly assessed by means of self-assessments. In contrast, physical attributes are measured without the involvement of users. A change in pricing is one example, where measures of numbers of boarding travellers (e.g., before and after the change) are used to infer how the users experience the price of the service. Redman et al. (2013) argue that it is crucial to recognize the effects of both perceived and physical attributes on user satisfaction, in order to improve public transport services. De Oña and De Oña (2015) however, discuss the complexity of the abstract concept that service quality in public transport constitutes, and call for new innovative methodological approaches for dealing with this complexity. As a response to this call, we apply a configurational approach in the present study, and introduce fuzzy-set Qualitative Comparative Analysis (fsQCA) (Ragin, 2008) to explore how satisfaction levels of a number of quality attributes are associated with overall travel satisfaction. The underlying aim of this paper is thus to examine how satisfaction with (combinations of) different service quality attributes contribute to high travel satisfaction in public transport. Furthermore, we also demonstrate the significance of contextual conditions on travel satisfaction by comparing the role of satisfaction with specific service quality attributes before and after a major change in the service offer has been made. We conclude that this study extends previous research by giving new insights into, and advancing the theoretical ground of, travel satisfaction. Furthermore, we discuss the advantages of the fsQCA method in understanding complex relationships in public transport.

The paper is organized as follows. Section 2 presents a definition of the concept of travel satisfaction, both satisfaction with specific service quality attributes and overall travel satisfaction. We then briefly present some analysis methods that are common in transport research. Each method is exemplified with some empirical results. The purpose is primarily to show that the focus has so far been on linear analysis methods and that methods that highlight configurations are lacking. Section 3 then describes the logic of Qualitative Comparative Analysis (QCA), followed by Section 4 which outlines our research propositions. Section 5 includes a method section with details on data collection and on how the fuzzy-set Qualitative Comparative Analysis (fsQCA) was employed. Section 6 presents the empirical results based on t-tests and fsQCA analyses. In Section 7, we discuss the findings in view of methodological, theoretical, and practical implications, and in Section 8 we conclude by summarizing our findings together with outlining limitations and suggestions for future research.

2. The concept of travel satisfaction

Satisfaction is a directly cognitive or affective response to travel encounters (Gärling et al., 2019). A general definition of satisfaction frequently adhered to in previous research is "… a judgment that a product or service feature, or the product or service itself, provided (or is providing) a pleasurable level of consumption-related fulfillment, including levels of under- and over fulfillment" (Oliver, 2010). Oliver (1980) and Oliver and DeSarbo (1988) have approached satisfaction research by emphasizing the satisfaction with single transactions (or encounters) with a specific service, while others have focused on cumulative satisfaction which regards several transactions, or encounters, over time (e.g., Bolton and Drew, 1991, Fornell, 1992, Westbrook and Oliver, 1991). For both approaches to satisfaction, satisfaction may be defined as an aggregated, overall concept (e.g. overall satisfaction), or captured as the level of satisfaction with a specific quality attribute, or with the performance of a system (e.g. Anderson and Sullivan, 1993, Cronin and Taylor, 1992, Gotlieb et al., 1994), and may be assessed by manifest or latent constructs. It should be noted that the concepts of service quality and satisfaction have been used interchangeably in the transport literature. For clarity, this study focuses on satisfaction with service quality attributes which differ from service quality evaluations (for a recent discussion on the differences between service quality and satisfaction see De Oña, 2020).

Transport researchers have used a variety of methods to capture travel satisfaction. In the 70 s/80 s, Stated Preference (SP) methods were introduced in transport research in order to increase the knowledge of how travelers value different characteristics of public transport (see Hensher et al., 1988, Kroes and Sheldon, 1988). In short, the SP method means that the individual evaluates a number of

presented (hypothetical) alternatives. A number of public transport journeys can be described with different lengths of travel time, waiting time and comfort, after which the traveler ranks, grades or chooses from the various alternatives. Prioni and Hensher (2000) applied the SP method in order to capture how travelers value a transit service by identifying the importance of each of the included service attributes on overall service quality. Marcucci and Gatta (2007) applied SP methods as well as choice-based conjoint analysis to assess travel satisfaction and create an index of service quality. In another SP study, Eboli and Mazzulla (2010) showed that having a bus stop near home qualifies as an important service quality attribute, followed by "safety on board and personal security". Overcrowded buses, service information, and bus stop facilities were in the same study identified as very critical service quality attributes important for the traveler's satisfaction.

It is also common to apply multivariate methods (e.g., multiple regression analyses or structural equation models) to investigate the theoretical relationships between service quality and the overall travel satisfaction. In Eboli and Mazzulla (2007), a structural equation model was applied in order to investigate the relationship between cumulative satisfaction and service quality attributes. By applying structural equation models, Friman et al. (2001) showed how the experience of frequently deviating negative encounters impact satisfaction with service attributes and the overall travel satisfaction. For instance, frequent experiences of delayed buses will eventually result in reports of unsatisfactory reliability with the service. With regression analysis, Ettema et al. (2012) showed that quality attributes are weighted differently depending on the final destination of the trip. As an example, talking to fellow passengers is weighted more positively when traveling home from work than it is while traveling on the way to work.

By applying several ordered regression models, De Oña et al. (2020) showed that service quality is defined differently by different segments of travelers, where frequency turned out to be important for all travelers included in the study, whereas speed and intermodality were only important attributes for some travelers' satisfaction. Surprisingly, neither accessibility nor individual space were found to be important at all. Thus, which quality attributes that play a role for overall travel satisfaction appear to vary in different contexts and for different segments of travelers.

In summary, general linear models have often been used so far to understand travel satisfaction. There is still a lack of alternative models, such as models with a configurational approach. The fuzzy-set qualitative comparative analysis (fsQCA) is an analytical method currently gaining momentum in other research fields such as organization research (e.g, Fiss, 2011), operations (e.g., Russo et al., 2019), and innovation management (e.g., Kraus et al., 2018; Sukhov et al., 2020). Following the De Oña and De Oña (2015) call for innovative methodological approaches, we apply the fsQCA (Ragin, 2008) to transport research by focusing on five commonly referred quality attributes (reliability/ functionality, information, courtesy/simplicity, comfort and safety) and how they relate to overall travel satisfaction. Section 3 outlines the logic of the qualitative comparative analysis.

3. The logic of the Qualitative Comparative Analysis

Qualitative Comparative Analysis (QCA), originating in comparative sociology and politics, was initially introduced by Charles Ragin as a mixed methods research approach (Ragin, 2014, Ragin, 2000, Ragin, 2008). This analytical approach builds on the logic of set-theoretic Boolean algebra, and implements the principles of case comparison, which is commonly used in qualitative studies (Ragin, 2014). As such, this method enables researchers to compare empirical cases and to outline the conditions whose presence or absence regulate the presence or absence of a specific outcome such as travel satisfaction. Qualitative Comparative Analysis requires the researcher to iterate between data, analysis and theory, and sensitize explanations for the empirically observed phenomena through an abductive research process (Furnari et al., 2020; Sukhov et al., 2020). This makes QCA a powerful research tool for simultaneously testing theoretical assumptions and building theoretical explanations.

The QCA logic builds on the desire to understand the occurrence of a specific outcome in its empirical context (Ragin, 2014). This method helps the researcher to maintain focus on multiple empirically relevant conditions that may act individually or jointly as configurations of conditions. QCA allows researchers to assess the *necessity* and *sufficiency* of conditions and configurations which in turn produce the outcome of interest. A *necessary condition* refers to the condition as always present when the specific outcome is observed (Rihoux and Ragin, 2008), and thus is needed in order for the outcome to occur. However, in addition to necessity, a condition may not be sufficient to generate the outcome on its own. Thus, QCA is also concerned about the sufficiency of conditions, that is that the outcome can only occur when certain conditions are satisfied (Schneider and Wagemann, 2012). In other words, QCA allows researchers to compare cases and analyse the influence of different conditions by assessing their relevance to the outcome. In doing so, QCA enables the researcher to take a wider configurational perspective, by theorizing how various combinations of conditions can act as recipes for a particular outcome (Furnari et al., 2020, Sihvonen and Pajunen, 2019). In contrast to this, a linear regression-based approach is aimed at top-down theory testing by finding a general explanation for the relationship between certain factors. Consequentially, regression-based methods can lead to dismissal of outliers that do not follow the hypothesised relationship (despite their empirical relevance) (Ragin, 2014). QCA allows the researchers to circumvent these challenges, and thus acts as an important complement to the research toolkit (Fiss, 2011, Ragin, 2014) and continues its growth as an apt method for configurational theorizing (Furnari et al., 2020, Greckhamer et al., 2018, Misangyi et al., 2017).

QCA is well suited for analysing complex webs of theorised cause-effect relationships (i.e. the method does not test causality experimentally, but helps in assessing the theorised causal link through analysis of necessity and sufficiency[1]). This helps the researcher to put complex interactions between conditions into coherent logical accounts and distinguish between different types of cases by, for instance, viewing them as "typologies" or "causal recipes" (Fiss, 2011, Furnari et al., 2020). As stated by several researchers (Furnari et al., 2020, Misangyi et al., 2017, Frösén et al., 2016, Woodside, 2013, Woodside et al., 2013, Ordanini et al., 2014), QCA allows the researcher to study *causal complexity*, which refers to situations "in which a given outcome may follow from several different combinations of causal conditions" (Ragin, 2008). In doing so, it is important that there is a theoretical link suggesting that a condition influences an outcome. QCA helps the researcher to compare cases and assess whether there are particular patterns of conditions across cases resulting in the outcome.

Furthermore, the QCA approach embraces the three main principles of causal complexity as described by Misangyi et al. (2017). The first principle, *conjunctural causation*, states that an outcome can occur as a result of a combination of multiple conditions. The rationale of this principle builds on the idea of social mechanisms, where multiple simultaneous events need to occur (several conditions which need to be fulfilled) in order for the specific outcome to happen (Sihvonen and Pajunen, 2019). Conjunctural causation relates to the notion that an outcome occurs in an intersection between several conditions and can be represented by the logical "AND" that is used in set-theoretic operations. This means that different conditions may jointly be sufficient to cause the occurrence of the specific outcome. As an example, imagine that the experience of high satisfaction is not due to satisfaction with a single service quality attribute (e.g., high functionality) but rather depends on the interplay between several satisfactions (e.g., satisfaction with high functionality AND high comfort). Thus, according to conjunctural causation, a phenomenon of study may be complex since it occurs in the interplay between different conditions.

The second principle, *equifinality*, suggests that there are several ways in which different configurations of conditions can relate to a specific outcome. This principle underlines that there need not exist only a single explanation for a certain occurrence, but in fact there could exist different reasons for the outcome to occur (Schneider and Wagemann, 2012). QCA emphasizes the value of understanding different possible scenarios that are linked to the outcome of interest, and by doing so takes into account the logical "OR" between different configurations resulting in the same outcome (Furnari et al., 2020). However, according to Goertz and Mahoney (2012), equifinality does not require causal combinations, and acts as a principle illustrating the possibility of disjunction between different concepts. The present study, focus on high overall travel satisfaction. As we know that people may exhibit different pre-travel attitudes (Gärling et al., 2019), and evaluate different sets of travel attributes altogether (Redman et al., 2013), a reasonable assumption is that different (sets of) service quality attributes are important for different segments of travellers, resulting in high overall travel satisfaction. Thus, the principle of equifinality suggests that high satisfaction could be a product of a number of different configurations of satisfying service quality attributes, such as, high satisfaction with functionality and comfort OR high satisfaction with information and simplicity.

Finally, *causal asymmetry*, suggests that a condition may be related to the outcome in one case but unrelated in another. In this sense, QCA differs from the implicit idea that is often present in correlational models, namely that factors leading to the absence of a phenomenon are the inverse of those factors that lead to its presence. On the contrary, the relationship between the conditions and the outcome does not have to be linear, which is why the outcome in QCA needs to be defined and calibrated into a particular representation of empirical properties (Woodside, 2013). As such, causal asymmetry corresponds to the notion of logical "NOT", suggesting that a condition does not have to be linearly related to the outcome, and that the absence of a condition may in itself act as a factor for the outcome to occur. For instance, a high satisfaction with comfort may be needed for high overall satisfaction to occur in some cases, but not needed in other cases, thus, it is possible that degree of comfort may be asymmetrical to high overall satisfaction.

QCA is most often performed in one of two ways. Either through a crisp set qualitative comparative analysis (csQCA), or a fuzzy set qualitative comparative analysis (fsQCA). In the csQCA the conditions and the outcomes are viewed as attributes that are either present within a defined set (crisp membership = 1) or absent, outside of the defined set (crisp membership = 0). This approach is useful when studying dichotomous variables (Sihvonen and Pajunen, 2019), or when strict boundaries between two states are clearly identified. However, it is common that a condition may be present or absent to a certain degree. In these situations, Greckhamer et al. (2018) suggest that a fuzzy-set approach is used, where the conditions and the outcome are determined based on the degree to which they correspond to a defined set. We can exemplify fuzzy membership logic on the different segments of car users identified by Anable (2005). The segments interpreted as fully in the set would be the "Die Hard Drivers" (fuzzy membership = 1.0), whereas those that are almost but not fully in would be coherent to the "Complacent Car Addicts" (fuzzy membership = 0.9). Those who are more out than in are segmented as "Aspiring Environmentalists" (fuzzy membership = 0.3), and so on until those who are considered fully out, that is "Reluctant Riders" (membership = 0). Thus, fsQCA can treat continuous data and partial membership to a defined set. However, in order for that to occur the data needs to be translated into particular states with clear qualitative labels (Ragin, 2000). This means that if a theoretical concept is measured by a 7-point Likert scale, the scores need to be calibrated so that the points on the scale correspond to particular qualitative anchors. A high point on the Likert scale would then indicate that the respondent agrees with the statement that is presented, whereas a low point on the Likert scale would indicate disagreement with the statement (or indicate agreement with

[1] QCA applies a conditional logic which does not make presumptions about causal direction or temporal order between conditions and the outcome. Conditional logic relies on theoretical explanations of the relationship between the concepts and assessment of conditional statements, e.g., 1) presence of X (condition) is necessary for Y (outcome); 2) absence of X is sufficient for Y. If statement (1) is true, then Y is a subset of X. This means that Y cannot occur without X, suggesting a theoretical causal link between X and Y. For more detail see e.g. Dul (2016), Goertz, (2003), Mackie (1965).

the polar opposite of the statement, depending on how the statement was formulated). However, the responses cannot be directly used in the fsQCA, since the researcher has to define the items and constructs as theoretical concepts, and assign set membership in the form of qualitative labels and thresholds that make sense in relation to theory and data. A thorough explanation of the application of fuzzy membership logic on different levels of satisfaction with service quality attributes is offered in the methods section (6.2). It should be pointed out that fsQCA is a case-orientated approach, not explicitly aimed at generalization (Ragin, 2014). In the following section we describe the steps necessary in the fsQCA.

3.1. The steps of fuzzy set qualitative comparative analysis

The process of fsQCA consists of finding reoccurring patterns in data and using practical and theoretical knowledge to formulate qualitative explanations for the observed patterns (labelled as configurations). According to Greckhamer et al. (2018), the procedure for applying fsQCA begins with the construction of the empirical sample. Then, the researcher needs to define the conditions, the outcome and the relations that are to be studied (see e.g., Frösén et al., 2016; Sukhov et al., 2020). In this step, it is important that each condition is clearly defined so that its presence or absence can be determined. Data calibration is a procedure where the empirical observations are interpreted according to external standards in order to give them meaning (Ragin, 2008). The external standards correspond to the set-membership scores, where the degree of presence and absence of the conditions and outcomes are translated into numerical expressions, which enables the algebraic part of the analysis. An important step when using a "continuous" fuzzy set calibration is that three main thresholds are defined as "fully in", "fully out" and "neither in nor out" (corresponding to the crossover point = 0.5). When specifying the qualitative anchors, the researcher needs to present a rationale for each of these breaking points (Rihoux and Ragin, 2008).

After preparing the data for analysis, the following step is to determine whether or not there are conditions which are *necessary* for the outcome. All cases that exhibit the outcome are analysed to see whether they contain the same condition(s). If there is a condition which is constantly present whenever the outcome occurs, it is determined as a necessary condition. Thus, the outcome will not occur without this condition.

The next analytical step is to perform a sufficiency analysis, where the researcher examines conditions in order to determine which of these (single conditions or configurations of conditions) that are sufficient to produce the outcome. In doing so, all of the empirical cases are compared with each other, and in order for the configuration to be considered sufficient, every case that contains the configuration also needs to contain the outcome (Schneider and Wagemann, 2012). For instance, if there are a number of cases which contain both a specific configuration and the outcome, while at the same time a substantial quantity of cases display the same configuration but without the outcome, the configuration cannot be considered sufficient.

Performing these analytical steps enables the researcher to understand the influence that the conditions exert on the outcome, and to formulate a theoretical understanding for their relationship. With fsQCA it becomes possible to determine whether there are conditions which are necessary but insufficient for the occurrence of the outcome, indicating that a condition is an inherent, or subset, part of the outcome (Ragin, 2008, Schneider and Wagemann, 2012). It also becomes possible to examine whether or not there are conditions which are sufficient, but not necessary, to produce the outcome, meaning that the outcome can occur due to other conditions. Thus, both necessity and sufficiency analyses need to be considered together when drawing conclusion. In this study, this approach helps to highlight the role of satisfaction with different service quality attributes and show their association with overall travel satisfaction.

The final step of the fsQCA is the robustness check, where different thresholds for calibration are introduced in order to evaluate the sensitivity of the findings. Ideally, small changes to the threshold values should result in the same configurations. However, introducing new conditions may radically change the logically possible configurations of conditions, consequentially changing the results. Therefore, an alteration of the configurational model is a possibility in the process, but should be done with caution if the purpose is theory testing (Greckhamer et al., 2018). The robustness check also includes evaluating empirical findings in light of theory (Sukhov et al., 2020). This is an important part of the analysis where the researcher searches for plausible coherence, finds main themes on the configurational level, and simplifies the combinations of conditions into higher-order constructs (Furnari et al., 2020). The main benefits of *fsQCA* is summarised in the following section.

3.2. Main benefits of fsQCA

*fs*QCA is a research method that builds on case comparison, which means that it outlines reoccurring patterns of conditions (i.e. configurations) across observed cases, and assess their relevance in relation to the defined outcome. This approach is best suited for exploring complex interactions by outlining how multiple attributes combine into distinct configurations to produce the outcome of interest, assessing whether multiple configurations link to the same outcome as well as the relative empirical importance of each of these configurations (Misangyi et al., 2017). In this way, fsQCA differs from conventional correlation-based methods with complex higher-order interactions which may in some cases be difficult to interpret due to multicollinearity (see Frösén et al., 2016 for more details) or presume symmetrical relationship between the predictor and the outcome variables (see Woodside, 2013). One of the key strengths of fsQCA is that it provides detailed information of different patterns across cases within a particular sample. This makes fsQCA appropriate for studying complex phenomena, such as overall travel satisfaction, where presence or absence of certain conditions may have different effects on the experience of the service. With fsQCA it is possible to explore necessary and sufficient conditions for high travel satisfaction. Thus, with fsQCA it is possible to shift the research focus from studying "key success factors" to "key success paths", which follow assumptions of having symmetrical relationship between key variables (Woodside et al., 2013).

Furthermore, fsQCA can be used to analyse both quantitative and qualitative data (see e.g. Sukhov et al., 2018; Sukhov et al., 2020). Although fsQCA has a variety of benefits, the findings are limited to the sample and the cases that are studied, and are also sensitive to the calibration decisions made by researchers (Greckhamer et al. 2018). Thus, this approach is not designed for testing general effects but rather for exploring and explaining how different factors bring about a certain outcome (Sukhov et al. 2020).

4. Research propositions

In the present study we apply fsQCA to investigate how satisfaction with a number of service quality attributes in public transport contribute to high overall travel satisfaction, before and after an intervention aiming at improving the service quality offer. Next, we present three propositions (P1, P2 and P3) built upon theoretical assumptions of travel satisfaction, to guide our research.

P1. High travel satisfaction is a multifaceted and holistic phenomenon that occurs in the interplay between different service quality attributes.

First, we propose that overall travel satisfaction is a product of satisfaction with multiple service quality attributes that act in conjunction with each other, rather than on their own, to build an overall evaluation. We therefore expect that high overall travel satisfaction is associated with configurations of different service quality attributes.

P2. No single best configuration of highly satisfactory attributes leads to high overall travel satisfaction, instead, there exists multiple configurations of highly satisfactory service quality attributes resulting in high overall travel satisfaction.

Secondly, we propose that, in order to explain high overall travel satisfaction, the traveler's satisfaction with different service quality attributes may be combined into a variety of different configurations. We expect that there is no general recipe to high overall travel satisfaction, but that there are a number of ways in which high travel satisfaction is formed by the users of public transport.

P3. The configurations that lead to high overall travel satisfaction differ before and after an improvement in service quality.

Thirdly, since previous research has indicated the importance of contextual factors for satisfaction with service quality and subsequently for overall travel satisfaction, we propose that the configurations of satisfactory service quality attributes associated with high overall travel satisfaction may change due to a change in the objective service offer. Contextual changes should thus alter the configurations of how satisfied travelers are with different service quality attributes.

Addressing these propositions helps us to understand the complexity of travel satisfaction in a systematic way. In the following section, we explain how we performed our data collection and conducted the research process.

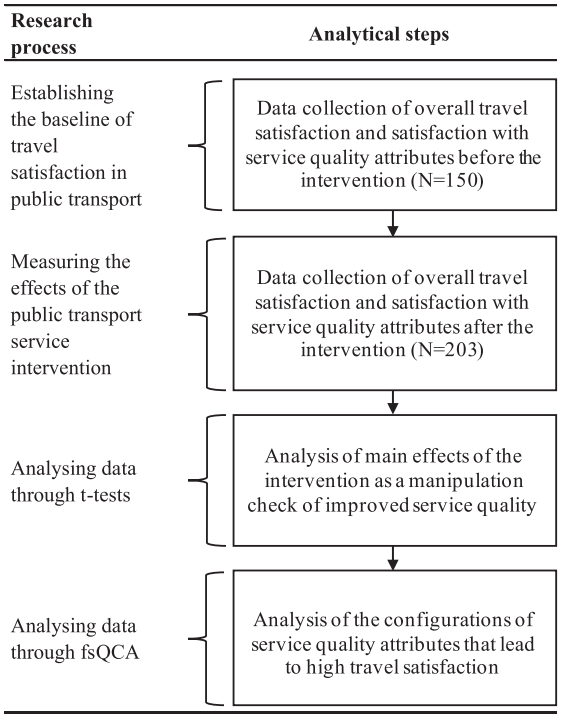

Fig. 1. Multi step research design.

5. Method

5.1. Data collection, contextual case and research process

Data collection was performed in Karlstad (a medium-sized city in Sweden) with approximately 90,000 inhabitants. Data was collected on two occasions, one in June 2013 (N = 150), and one in May 2014 (N = 203), before and 10 months after an intervention with focus on improving the quality of the public transport system. The public transport system in Karlstad includes eight baselines, three center lines, and a number of lines for special services (for elderly and users with disabilities). In 2013, the whole bus fleet was replaced by new biogas buses with air conditioning. Instead of stairs, the new buses had low floors facilitating boarding, and the lighting was improved. Moreover, the new buses were equipped with free Wi-Fi and Infotainment onboard (Bus TV). A real-time information system on large flat screens was implemented, listing the departure times for all buses departing from each stop. To improve security, the new buses were also equipped with surveillance cameras. The route network was also redesigned, and transfers between different routes were improved. A new system map was launched with a simple and clear layout. The physical design of the bus stops was also altered. Moreover, incentives in tendered contracts were set up with bonuses and penalties linked to service quality as well as to the number of travellers.

An outline of our multi step research process is presented in Fig. 1. The first step was to establish the baseline and collect data on overall travel satisfaction and satisfaction with each of the included service quality attributes by means of a survey. Following the intervention, a second data collection occurred where an identical survey was distributed. On both occasions data was collected between 8 in the morning and 5 in the afternoon for three subsequent days.

The data were first analysed using t-tests as a manipulation check of the intervention, where the degree of overall travel satisfaction and satisfaction levels of each of the included service quality attributes were compared before and after the intervention. The data was then analysed applying the fsQCA method.

5.2. Sample

The sample consisted of travellers between 16 and 87 years of age (mean age 26 years reflecting the user population at the time of study according to a travel behaviour survey [Sweco, 2014]). The participants were approached at stops or on-board buses and were asked to fill in a questionnaire distributed on clip-boards, which took about five minutes to complete. When agreeing to participate, the participants were offered a ticket for the lottery, with the chance to win a free 30-day bus-pass. Most participants were on their way to or from school or work, or used the bus to get to or from a social activity. Moreover, 90% of the respondents were high-frequent users (corresponding to going by bus every week or more frequently). Descriptive data of the participants in sample 1 and 2 can be found in Table 1.

5.3. Survey description

In order to measure satisfaction with service quality, the questionnaire included a number of items evaluating satisfaction with service quality attributes. The participants were asked to grade their satisfaction with the service attributes in general, not for just the actual day of the survey. The items were divided into five main service quality attributes; *reliability/functionality*, *information*, *courtesy/simplicity*, *comfort*, and *safety* (based on factor analyses from a previous study, see Lättman et al., 2016). Items related to reliability/functionality, information, courtesy/simplicity, and comfort the statement "*I am satisfied with*…", was rated on seven-point scales ranging from 1 "completely disagree" to 7 "completely agree". The item related to safety was phrased as "*I feel safe and secure*" and rated on the same seven-point scale.

In addition to satisfaction with service quality attributes, an overall measure of travel satisfaction was included in the form of the Satisfaction with Travel Scale (STS) (see e.g. Ettema et al., 2011, Friman et al., 2013). The scale uses seven-point bi-polar adjectives to evaluate cognitive and affective experiences of overall travel satisfaction. Analyses of the psychometric properties of the scale have shown that it can either be used to assess separate dimensions of satisfaction (affective and cognitive), or as a general overarching index of overall travel satisfaction (Friman et al., 2013). The STS has been used and validated extensively in public transport studies, as well as for other modes of transport (e.g. De Vos et al., 2015, Glasgow et al., 2018, Olsson et al., 2012, Olsson et al., 2013, Singleton, 2019). Both nine-item versions and three-item versions of the STS have been employed, for children and for adults. In the present study the three-item adult version was used and collapsed into an overarching single index for the analyses of overall travel satisfaction (Olsson et al., 2013). In Table 2, all items measuring satisfaction with the service quality attributes and overall travel satisfaction are displayed. As can be seen, the number of items varied from six to one.

Table 1
Participant descriptives.

	Sample 1 (before intervention)	Sample 2 (after intervention)	Total
N	150 (women 68%)	203 (women 54.2%)	353 (women 60.1%)
Mean (years)	25.9	26.6	26.3
Minimum	16	16	16
Maximum	69	87	87

6. Results

To address the research aim, a multi-step research design was employed (see Fig. 1). As a manipulation check, we initially investigated the effect of the intervention on satisfaction with service quality attributes and overall travel satisfaction, by means of a number of t-tests. Following this, we conducted the fuzzy set qualitative comparative analysis in order to obtain a better understanding of the cases that are related to high travel satisfaction, and to test our propositions. This allowed us to examine whether high travel satisfaction is the outcome of an interplay between satisfaction with multiple service quality attributes (proposition P1); whether different configurations of service quality conditions can lead to high travel satisfaction (proposition P2); and whether configurations leading to high travel satisfaction before the intervention differ to the configurations after the intervention (proposition P3). In the following sections, our findings are reported in more detail.

6.1. T-tests

T-tests for independent samples (n = 150, n = 203) were initially performed; one for satisfaction with each of the included service attributes; *reliability/functionality*, *information*, *courtesy/simplicity*, *comfort*, *safety*, and for *overall travel satisfaction*. According to the analyses, the intervention of introducing the new bus service system resulted in improved *overall travel satisfaction*, and an increase in satisfaction with all of the quality attributes with the exception of *information* (see Table 3).

These results indicate that changes in context (i.e. the intervention) had a significant effect on how satisfied users are with different service attributes. The intervention of the bus system led to an increase in satisfaction with service quality (apart from the ratings of *information*) and overall travel satisfaction. Thus, by only looking at these findings it would be possible to argue that in order to increase the overall level of travel satisfaction and improve the service quality, managers can invest in newer biogas buses, install air conditioning, improve boarding and lighting, and install free Wi-Fi and infotainment. By installing surveillance cameras, it appears possible to also improve the on-board safety. However, installment of real-time information systems and large flat screens at the bus stops, along with improving the homepage and mobile apps did not seem to have an effect on the satisfaction with *information*.

6.2. fsQCA

For the analysis, the fsQCA 3.0 software package (Ragin and Davey, 2016) was used to calibrate the overall travel satisfaction and the satisfaction with different attributes (see Table 4 for an overview of the calibration procedure). During calibration from the 7-point

Table 2
Satisfaction with service quality attributes and overall travel satisfaction, and their corresponding item(s).

Satisfaction with service quality attributes	Items			Before		After	
				Mean	St. d.	Mean	St. d.
	"I am satisfied with the…"						
Reliability/functionality (6 items)	*…travel time.*			5.14	1.42	5.73	1.21
	…number of departures.			4.91	1.57	5.52	1.37
	…distance to the nearest bus stop.			5.77	1.34	5.82	1.30
	…trip coordination during transfers.			4.39	1.36	4.85	1.43
	…way I am paying for the trip.			4.40	1.97	5.25	1.62
	…punctuality.			4.25	1.64	4.33	1.60
Information (3 items)	*… [bus provider's] mobile app.*			5.05	1.63	5.30	1.62
	…information provided on the [bus provider's] homepage.			5.16	1.43	5.31	1.38
	…information provided at the bus stops.			5.02	1.46	5.22	1.38
Courtesy/simplicity (4 items)	*…onboard announcements.*			5.04	1.55	5.58	1.39
	…the driver's attitude/behavior.			4.57	1.55	5.19	1.40
	…written information provided onboard the buses.			4.85	1.49	5.22	1.34
	…boarding and exiting.			5.09	1.36	5.55	1.28
Comfort (6 items)	*…air quality onboard.*			3.43	1.69	5.18	1.47
	…cleanliness onboard.			4.15	1.51	5.57	1.18
	…lighting onboard.			5.39	1.29	5.83	1.21
	…noise level onboard.			4.65	1.46	4.98	1.48
	…comfort.			4.75	1.36	5.78	1.05
	…number of seats/available space.			4.43	1.56	5.35	1.35
Safety (1 item)	***I feel safe and secure***			5.67	1.17	6.13	1.10
Overall Travel Satisfaction							
STS (3 items)	*I feel very stressed, hurried, worried*	***vs.***	*I feel relaxed, calm, confident*	4.16	1.31	4.72	1.23
	I feel very bored, tired, fed up	***vs.***	*I feel very enthusiastic, alert, engaged*	3.63	1.32	3.90	1.33
	The trips work very poor, have low standard, are the worst possible	***vs.***	*The trips work very good, have high standard, are the best possible*	4.09	1.26	4.58	1.24

Table 3
Results of the two-tailed t-tests before and after the intervention.

Satisfaction with Service Quality Attributes	Sample	N	Mean	Std. Deviation	t	p
Reliability/Functionality	Before	150	4.81	1.02	4.07	<0.05
	After	203	5.25	0.98		
Information	Before	150	5.07	1.26	1.47	0.14
	After	203	5.25	1.25		
Courtesy/Simplicity	Before	150	4.88	1.08	4.50	<0.05
	After	203	5.38	0.99		
Comfort	Before	150	4.46	1.08	9.27	<0.05
	After	203	5.45	0.90		
Safety	Before	150	5.67	1.17	3.79	<0.05
	After	203	6.13	1.10		
Overall Travel Satisfaction	Before	150	4.81	1.46	2.90	<0.05
	After	203	5.24	1.26		

Likert scale into a fuzzy membership score, the membership score attaches a *truth value* between 0 and 1 to a statement (e.g. the statement that a person is highly satisfied with safety while traveling) (Ragin, 2008). Thus, if the *truth value* of the statement "I feel very safe and secure" is 0.10, it means that this statement is almost but not completely out of the set of true statements, thus the travellers are not satisfied with their safety and security during travel. The satisfaction level with each of the service quality attributes was calibrated as either present in the set (corresponding to a state of high satisfaction), absent from the set (corresponding to a state of low satisfaction), or partially present or absent from the set (corresponding to the degree of being more or less satisfied). Specifically, during calibration we transformed the aggregated data for each service quality attribute into set-membership scores. This meant that we needed to define three threshold points that allowed us to code the data based on the degrees of presence and absence of the conditions (a state of satisfaction with different service quality attributes) and the outcome (the state of high overall travel satisfaction). The first threshold of "fully in [the set]" corresponded to the score 6 and above on the 7-point Likert scale. This indicated a high state of satisfaction with the specific service quality attribute, for instance, feeling highly satisfactory with the *comfort* or *safety onboard*. The second threshold "fully out [of the set]" corresponded to the score 2 and below on the Likert scale. This score confirmed to a state of low satisfaction. The final threshold was set for the crossover point (0.5) corresponding to point 4 on the Likert scale, where the travellers was neither satisfied nor dissatisfied. Scores above the crossover point indicated the gradient at which the travelers, more or less, agreed with the statement of being highly satisfied, with scores below the crossover point corresponding to the gradient at which the respondents, more or less, disagreed with the statement of being highly satisfied. Accordingly, we calibrated the overall travel satisfaction, allowing us to focus specifically on outlining conditions that lead to a state of high overall travel satisfaction (e.g. fully in the set). Essentially, the fsQCA enabled us to examine five-way interactions in all possible combinations between the three levels of satisfaction with the service quality attributes.

6.2.1. Necessity analysis

The first step of data analysis with fsQCA involved testing each individual service quality attribute for necessity. This helped us to understand whether there are conditions (attributes) that are always present (or absent) (Schneider and Wagemann, 2012) for high overall travel satisfaction. To execute this analysis, we examined the values of *consistency* and *coverage*. *Consistency* outlines the proportion of cases including a specific condition, and which also exhibit the outcome (Rihoux and Ragin, 2008), and is analogous to a measure of the model's validity. A general threshold for a necessary condition is a value above 0.90 (Greckhamer et al., 2018). *Coverage*, on the other hand, indicates the degree of relevance of the necessary condition for the outcome. Values of coverage should always be considered together with the consistency (Ragin, 2008). A value of high consistency and high coverage means that the quantity of cases exhibiting the condition is proportionate to the number of cases exhibiting the outcome, making a necessary condition relevant (Schneider and Wagemann, 2012). A high consistency with low coverage indicates that the cases exhibiting the condition is disproportionate to the quantity of cases exhibiting the outcome which makes a necessary condition trivial.

In Table 5 we present the values of consistency and coverage of satisfaction with each service quality attributes in relation to high overall travel satisfaction. The necessity analysis reveals that before the intervention only presence of *safety* was a necessary condition

Table 4
Calibration of conditions and outcomes into fuzzy sets.

Service Quality Attribute	Items (see Table 2 for phrasing of each item)	Cronbach's Alpha (before/after)	Type	Calibration (fsQCA thresholds)
Reliability/ Functionality	Six items	0.74/0.77	Condition	**Full membership** (0.95) correspond to score $\geq$ 6 on the Likert-scale, indicating high satisfaction.
Information	Three items	0.78/0.81	Condition	**Crossover point** (0.5) correspond to score 4 on the Likert-scale,
Courtesy/Simplicity	Four items	0.70/0.71	Condition	indicating neither satisfaction nor dissatisfaction.
Comfort	Six items	0.82/0.79	Condition	**Full non-membership** (0.05) correspond to score $\leq$ 3 on the
Safety	One item	N/A	Condition	Likert-scale, indicating low satisfaction.
Overall Travel Satisfaction	Three items	0.80/0.69	Outcome	

for high overall travel satisfaction, exceeding the consistency threshold of 0.90 (Greckhamer et al., 2018) and demonstrating its relevance by having high coverage (above 0.70). However, after the intervention, satisfaction with four service quality attributes is necessary, *functionality/reliability*, *courtesy/simplicity*, *comfort*, and *safety,* for high overall travel satisfaction.

Based on this analysis, satisfactory scores with *safety* onboard is necessary for high overall travel satisfaction both before and after the intervention. To feel satisfactorily safe is thus interpreted as a subset of high overall travel satisfaction. Satisfaction with *courtesy/simplicity* and *comfort*, become necessary only after the intervention together with *reliability/functionality*. Thus, high overall travel satisfaction after the intervention cannot be achieved without high satisfaction with *safety*, *courtesy/simplicity*, *comfort*, and *reliability/functionality*.

6.2.2. Sufficiency analysis

The next step in fsQCA involves examining which conditions, or configurations of conditions, that are sufficient to produce high overall travel satisfaction. This is achieved by comparing all cases to each other with the help of a truth-table (Rihoux and Ragin, 2008), and examining the consistency of different configurations that generate the specified outcome (Schneider and Wagemann, 2012). Furthermore, this step should also be supplemented with forming explanations for the configurations leading to the outcome by using theoretical and/or substantive knowledge (Furnari et al., 2020, Greckhamer et al., 2018, Sukhov et al., 2020). Table 6 depicts all of the identified configurations of satisfaction with service quality attributes associated with high overall travel satisfaction, and our qualitative interpretations of these configurations. The analysis revealed that no single condition is sufficient for high overall travel satisfaction on its own, which means that high overall travel satisfaction is a result of satisfaction with multiple service quality attributes that act in conjunction with each other. This confirmed our first proposition (P1) and revealed the complex and holistic nature of overall travel satisfaction.

In total, we identified four distinct configurations, three of which were associated with high overall travel satisfaction before the intervention (configurations 1a, 1b and 1c), and one that was associated with high overall travel satisfaction after the intervention (configuration 2). In Table 6, the configurations are presented vertically, where black circles ("●") indicate the presence of a condition (i.e., high satisfaction with a service quality attribute) within a configuration, and circles with a cross-out ("⊗") indicate the absence of a condition (i.e., low satisfaction with a service quality attribute). Blank spaces indicate the "don't care" conditions which means that neither presence nor absence of a condition matter for the outcome to occur. Next, we present a more detailed interpretation of the configurations.

6.2.3. Interpretation of the configurations

As shown in Table 6, before the intervention, three possible configurations were associated with high overall travel satisfaction (configurations 1a, 1b, and 1c). This confirmed our second proposition (P2) that high overall travel satisfaction is prone to equifinality, meaning that different configurations can produce the same outcome. Configuration 1a indicates that the most crucial components of service quality associated with high overall travel satisfaction are the presence of high satisfaction with information combined with satisfaction with courtesy/simplicity and safety. Note that neither presence nor absence of satisfaction with comfort or reliability/functionality mattered for high overall travel satisfaction in this configuration. Configuration 1a offers the most parsimonious solution across the dataset by having high values of coverage, and can be understood as a scenario where the travelers are highly satisfied with travel because they are satisfactorily informed, and evaluate the service as satisfactorily simple and safe.

Configuration 1b involved a different combination of conditions: presence of information, presence of safety, but absence of comfort. The absence of satisfaction with comfort means that although the comfort is unsatisfactorily, it is still possible to experience high overall travel satisfaction if the travel is satisfactorily safe and the user is satisfied with the information provided (e.g., via app, homepage, and/or at the bus stop). For instance, during rush-hour, with less seat availability and the probability of congestion, it is still possible to experience high overall travel satisfaction if the travel is satisfactorily safe and the information given is satisfactory.

Configuration 1c, illustrates a situation where the travelers are less satisfied with the comfort and the reliability/functionality, but evaluate the service as satisfactorily safe and simple. Even though the service is not experienced as satisfactorily reliable and

Table 5
Necessity analysis for high overall travel satisfaction.

	Before the intervention		After the intervention	
	Consistency	Coverage	Consistency	Coverage
Conditions				
Reliability/Functionality	0.87	0.84	**0.91**	0.87
~Reliability/Functionality	0.33	0.74	0.22	0.82
Information	0.86	0.79	0.88	0.86
~Information	0.29	0.75	0.23	0.80
Courtesy/Simplicity	0.86	0.82	**0.92**	0.86
~Courtesy/Simplicity	0.32	0.76	0.19	0.83
Comfort	0.75	0.83	**0.93**	0.85
~Comfort	0.44	0.76	0.19	0.89
Safety	**0.94**	0.76	**0.95**	0.80
~Safety	0.17	0.72	0.11	0.92

Note: The tilde symbol (~) indicates negation i.e., *~Comfort* indicates the absence of comfort.

Table 6
Sufficiency analysis for high overall travel satisfaction.

Configuration	Before the intervention			After the intervention
	1a	1b	1c	2
Condition				
Reliability/ functionality			⊗	●
Information	●	●		
Courtesy/ simplicity	●		●	●
Comfort		⊗	⊗	●
Safety	●	●	●	●
Qualitative interpretation of the configurations	*I'm well informed, it's simple and safe*	*Uncomfortable, but I'm well informed and safe*	*Unreliable, uncomfortable, but simple and safe*	*When everything works well the information doesn't matter*
Consistency	0.85	0.86	0.86	0.87
Raw coverage	0.77	0.37	0.26	0.86
Unique coverage	0.43	0.03	0.02	0.86
Solution consistency	**0.83**			**0.86**
Solution coverage	**0.84**			**0.87**

Note: Black circles "●" indicate the presence of a condition, while circles with a cross-out "⊗" indicate the absence, and blank spaces indicate that neither the presence nor absence of a condition matters to the configuration. Grey circle "●" indicates the presence of a condition that was identified as necessary but that did not show in the sufficiency analysis.

comfortable, this configuration still results in high overall travel satisfaction, which shows that there are travelers for whom reliability/functionality and comfort are not essential for the experience of high overall travel satisfaction.

After the intervention, only one configuration (Configuration 2 in Table 6) is associated with high overall travel satisfaction. This configuration includes satisfaction with courtesy/simplicity, comfort and safety, while the satisfaction with other attributes is less relevant. However, looking at the necessity analysis, satisfaction with reliability/functionality is a necessary condition for high overall travel satisfaction, alongside comfort, safety, and courtesy/simplicity. Since both necessity and sufficiency analyses need to be consulted in order to fully interpret the results of fsQCA, we conclude that satisfaction with reliability/functionality interplay with the other necessary attributes (and marked it with a grey circle in Table 6). Hence, high overall travel satisfaction is achieved when users are satisfied with all service quality attributes apart from information, which is not crucial for overall travel satisfaction. Subsequently, the interpretation of this scenario is that as long as everything else works satisfactorily the information does not matter for overall travel satisfaction. This may be because the travelers in our study (mainly frequent travelers) are not depended on the information.

As we can see from the results of the fsQCA there are multiple ways through which the travelers may experience high overall travel satisfaction. Before the intervention there were three different configurations that resulted in high overall travel satisfaction, with safety being the only necessary condition. After the intervention, an interplay between four conditions was observed for overall travel satisfaction. The results clearly show that the prerequisites for overall travel satisfaction changes with contextual changes, confirming our third (P3) proposition.

6.2.4. Summary

Our findings show that travel satisfaction is a multifaceted and complex phenomenon where satisfaction with multiple service quality attributes interplay and jointly contribute to high overall travel satisfaction. We also find that, before the intervention, different configurations of satisfaction with service quality attributes are associated with high overall travel satisfaction. For instance, low satisfaction with reliability/functionality and comfort can be compensated for by high satisfaction with courtesy/simplicity and safety. After the intervention, the general levels of satisfaction with service quality and overall travel satisfaction increased and all attributes (except information) needed to be experienced as satisfactory in order to experience high overall travel satisfaction. Thus, contextual improvements in the public transport service system altered travelers' experiences, both at an attribute and overall satisfaction level.

7. Discussion

The underlining aim of this study was to explore how satisfaction with different service quality attributes contribute to high overall travel satisfaction. In order to achieve this aim we used a configurational approach and introduced the fuzzy set Qualitative Comparative Analyses (fsQCA). Utilizing fsQCA allowed us to unveil complex configurations by analysing the association between satisfaction with different service quality attributes and high overall travel satisfaction before and after an intervention. This approach responds to some methodological limitations (i.e. linear assumptions) that have been discussed in regression-based methods. The necessity and sufficiency of satisfaction with a number of service quality attributes for overall travel satisfaction was analysed, and we found that safety was the only necessary condition associated with high overall travel satisfaction before the intervention. Safety also remained a necessary condition after the intervention, albeit together with other necessary conditions. This highlights that safety is an inherent attribute of high overall travel satisfaction. The fsQCA approach provided a number of explanations for high overall travel satisfaction, which offer additional knowledge for understanding overall travel satisfaction in the specific context.

Our results also provide an explanation of how satisfaction with different service quality attributes configure to facilitate high overall travel satisfaction. Guided by three research propositions, we examined empirical cases in order to outline the necessary and sufficient conditions for high overall travel satisfaction. Our first proposition suggested that high overall travel satisfaction is associated with satisfaction with several different service quality attributes that act in conjunction with each other. The analysis confirmed this assumption, and showed that several service quality attributes were jointly responsible for the overall travel satisfaction. The results we present by using the fsQCA method not only confirm previous findings of the importance of satisfaction with service attributes such as safety or comfort for overall satisfaction in public transport (e.g., Friman and Fellesson, 2009, Van Lierop et al., 2018, Susilo et al., 2015, Redman et al. 2013) but also emphasize more complex relationships of satisfactory quality attributes (i.e. configurations) that are associated with a high overall travel satisfaction. The existence of several configurations in order to achieve satisfaction has previously been confirmed in railway services (Miranda et al., 2018), which is the only other public transport study employing the fsQCA-method as the authors are aware of.

Our second proposition suggested that there can be multiple combinations of satisfaction with service quality attributes which may lead to high overall travel satisfaction. We found that, before the intervention, there were three distinct configurations of service quality attributes leading to high overall travel satisfaction. Configuration 1a described situations where the traveler was satisfied with the provided information, and considered the service to be satisfactorily simple to use and to be safe; Configuration 1b described situations where the traveler was unsatisfied with the comfort, but at the same time felt satisfied with the information provided and satisfactorily safe; while Configuration 1c described situations where the service was not satisfactorily reliable or comfortable, but satisfactorily simple to use and safe. These configurations highlight that despite the presence of (some) inferior service quality attributes, it is still possible for the travelers to experience high overall travel satisfaction, if the service quality attributes are satisfactorily combined. The findings also revealed that reliability/functionality and comfort exhibited asymmetrical relationships with overall travel satisfaction. In other words, low satisfaction with these service quality attributes could be compensated by satisfactorily levels of safety, simplicity, and information.

Our third proposition suggested that contextual circumstances affect the interplay between satisfaction with service quality attributes and overall travel satisfaction. When comparing experiences before and after the intervention, we found a significant increase in satisfaction after the intervention with all attributes except for information, which remained at the same satisfaction level. This means that the intervention improved both satisfaction with service quality attributes and the overall travel satisfaction. Furthermore, when we compared the configurations associated with high overall travel satisfaction after the intervention, we found that satisfaction with all service quality attributes, except for information, was needed for high overall travel satisfaction. One interpretation is that the intervention raised users expectations of service quality apart from the information provided (which also was experienced as equally satisfactory before and after the intervention). Thus, interventions alter expectations which play a key role in satisfaction with service quality as well as for overall travel satisfaction.

Applying fsQCA allowed us to compare empirical cases and trace the reoccurring patterns that produce high overall travel satisfaction. By using the fsQCA in public transport research it is possible to maintain a focus on the individuals and their experiences, while in conventional analyses (e.g. regression analysis) this connection is somewhat downplayed since general, rather than individual, effects are examined. Policymakers who want to understand and address experiences that are contextually relevant (such as local/regional interventions), should consider applying fsQCA as the approach has a decentralised logic and account for the local context. By using fsQCA we found that frequent users of public transport do not require high satisfaction of all service quality attributes to experience high overall travel satisfaction, but rather that there are distinct configurations where low satisfaction with some service quality attributes can be compensated by high satisfaction with others.

8. Conclusions and future research

In our findings, we observe that high overall travel satisfaction is associated with different configurations of satisfaction with service quality attributes, and that safety has an inherent part in overall travel satisfaction. After the intervention, the overall travel satisfaction significantly increased, leading to a situation where almost all service quality attributes needed to generate high satisfaction in order for the users to experience high overall travel satisfaction. Thus, we show that overall travel satisfaction is not associated with satisfaction with a single service quality attribute, but rather is generated from configurations of satisfaction with multiple service quality attributes. These configurations are context dependent and can be identified with the help of fsQCA.

We acknowledge that fsQCA is not that frequently used in transport research, and that the present study is one of the first to apply it on travel satisfaction. We therefore welcome and encourage others to follow, to analyze and discuss the value of fsQCA for the transport community. The main benefits of using fsQCA is that it allows researchers and managers to better assess relevance of certain attributes in specific contexts, and to identify configurations of conditions that are associated with the outcome of interest. Although fsQCA is not designed for outlining general relationships between key variables, it can be used for the purpose of providing nuance, exploring and explaining cases that may deviate from the general trend. Doing so can help researchers to build a more in-depth understanding for complex phenomena (by accounting for asymmetry, equifinality and conjunctural causation), and be a valuable asset for examining higher order constructs through configurational theorizing. We propose that fsQCA studies should complement conventional methods in travel satisfaction research and thus expand the research toolbox.

By applying the fsQCA we observed a nuanced picture with different configurations of satisfaction with service attributes associated with high overall travel satisfaction. If this specific outcome is related to the type of intervention implemented in this case study can be a focus for future research. The time-lag between the before and the after survey may have influenced the number of configurations as well as the traveler demands, however so far, we have no experience of previous fsQCA studies that have included a temporal

dimension in the analysis of the results. This can also be an important component to add in further research. Moreover, as we analyzed cross-sectional data, we recommend future studies to also include panel data in order to reveal potential within-individual changes in configurations as a response to contextual changes. By applying different segmentation variables, it may also be possible to learn more of how groups of individuals differ in configurations of important service quality attributes. The fsQCA should also be put into test in other transportation contexts beyond public transport.

Finally, we propose that in order to increase travel satisfaction in local contexts of public transport, focus should primarily be on understanding how satisfaction with different service quality attributes are configured together so that they provide the highest value. This configurational approach can lead to a broader understanding of the traveler experience and work as a development tool when improvements are to be made in existing services. We argue that fsQCA can become a valuable complementary method for the transport community.

CRediT authorship contribution statement

Alexandre Sukhov: Conceptualization, Data curation, Formal analysis, Methodology, Validation, Visualization, Writing - original draft, Writing - review & editing. **Katrin Lättman:** Conceptualization, Formal analysis, Investigation, Methodology, Validation, Writing - original draft, Writing - review & editing. **Lars E. Olsson:** Conceptualization, Formal analysis, Investigation, Methodology, Validation, Visualization, Writing - original draft, Writing - review & editing. **Margareta Friman:** Conceptualization, Formal analysis, Investigation, Methodology, Validation, Writing - original draft, Writing - review & editing. **Satoshi Fujii:** Conceptualization, Methodology, Writing - original draft, Writing - review & editing.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Acknowledgements

This research was financed by the Anne-Marie and Gustaf Ander Foundation (visiting professor's grant to S. Fujii at Karlstad University), and by the Swedish Energy Agency (Grant No. 50504-1).

References

Anable, J., 2005. 'Complacent car addicts' or 'aspiring environmentalists'? Identifying travel behaviour segments using attitude theory. Transp. Policy 12, 65–78.
Anderson, E.W., Sullivan, M.W., 1993. The antecedents and consequences of customer satisfaction for firms. Market. Sci. 12, 125–143.
Bolton, R.N., Drew, J.H., 1991. A longitudinal analysis of the impact of service changes on customer attitudes. J. Market. 55, 1–9.
Cronin Jr, J.J., Taylor, S.A., 1992. Measuring service quality: a reexamination and extension. J. Market. 56, 55–68.
De Oña, J., 2020. Understanding the mediator role of satisfaction in public transport: a cross-country analysis. Transp. Policy.
De Oña, J., De Oña, R., 2015. Quality of service in public transport based on customer satisfaction surveys: A review and assessment of methodological approaches. Transport. Sci. 49, 605–622.
De Oña, J., De Oña, R., Eboli, L., Mazzulla, G., 2013. Perceived service quality in bus transit service: a structural equation approach. Transp. Policy 29, 219–226.
De Oña, J., Estévez, E., De Oña, R., 2020. Perception of public transport quality of service among regular private vehicle users in Madrid, Spain. Transp. Res. Rec. 2674, 213–224.
De Vos, J., Schwanen, T., Van Acker, V., Witlox, F., 2015. How satisfying is the Scale for Travel Satisfaction? Transport. Res. Part F: Traffic Psychol. Behav. 29, 121–130.
Dul, J., 2016. Necessary Condition Analysis (NCA). Logic and methodology of "necessary but not sufficient" causality. Organiz. Res. Methods 19 (1), 10–52.
Eboli, L., Mazzulla, G., 2007. Service quality attributes affecting customer satisfaction for bus transit. J. Public Transport. 10, 2.
Eboli, L., Mazzulla, G., 2010. How to capture the passengers' point of view on a transit service through rating and choice options. Trans. Rev. 30, 435–450.
Ettema, D., Friman, M., Gärling, T., Olsson, L.E., Fujii, S., 2012. How in-vehicle activities affect work commuters' satisfaction with public transport. J. Transp. Geogr. 24, 215–222.
Ettema, D., Gärling, T., Eriksson, L., Friman, M., Olsson, L.E., Fujii, S., 2011. Satisfaction with travel and subjective well-being: Development and test of a measurement tool. Transport. Res. Part F: Traffic Psychol. Behav. 14, 167–175.
Ettema, D., Gärling, T., Olsson, L.E., Friman, M., 2010. Out-of-home activities, daily travel, and subjective well-being. Transport. Res. Part A: Policy Pract. 44, 723–732.
Fiss, P.C., 2011. Building better causal theories: a fuzzy set approach to typologies in organization research. Acad. Manage. J. 54, 393–420.
Fornell, C., 1992. A national customer satisfaction barometer: The Swedish experience. J. Market. 56, 6–21.
Friman, M., Edvardsson, B., Gärling, T., 2001. Frequency of negative critical incidents and satisfaction with public transport services. I. J. Retailing Consumer Services 8, 95–104.
Friman, M., Fellesson, M., 2009. Service supply and customer satisfaction in public transportation: The quality paradox. J. Public Transport. 12, 4.
Friman, M., Fujii, S., Ettema, D., Gärling, T., Olsson, L.E., 2013. Psychometric analysis of the satisfaction with travel scale. Transport. Res. Part A: Policy Pract. 48, 132–145.
Frösén, J., Luoma, J., Jaakkola, M., Tikkanen, H., Aspara, J., 2016. What counts versus what can be counted: The complex interplay of market orientation and marketing performance measurement. J. Market. 80, 60–78.
Furnari, S., Crilly, D., Misangyi, V.F., Greckhamer, T., Fiss, P.C., Aguilera, R., 2020. Capturing causal complexity: heuristics for configurational theorizing. Acad. Manage. Rev.
Gärling, T., Bamberg, S., Friman, M., 2019. The role of attitude in choice of travel, satisfaction with travel, and change to sustainable travel. In: Handbook of Attitudes. Routledge.
Glasgow, T.E., Geller, E.S., Le, H.T., Hankey, S., 2018. Travel mood scale: Development and validation of a survey to measure mood during transportation. Transport. Res. Part F: Traffic Psychol. Behav. 59, 318–329.
Goertz, G., 2003. The substantive importance of necessary condition hypotheses. Necessary conditions: Theory, methodology, and applications, 65–94.
Goertz, G., Mahoney, J., 2012. A Tale of Two Cultures: Qualitative and Quantitative Research in the Social Sciences. Princeton University Press.

Gotlieb, J.B., Grewal, D., Brown, S.W., 1994. Consumer satisfaction and perceived quality: complementary or divergent constructs? J. Appl. Psychol. 79, 875.
Greckhamer, T., Furnari, S., Fiss, P.C., Aguilera, R.V., 2018. Studying configurations with qualitative comparative analysis: Best practices in strategy and organization research. Strategic Organiz. 16, 482–495.
Hensher, D.A., Barnard, P.O., Truong, T.P., 1988. The role of stated preference methods in studies of travel choice. J. Trans. Econ. Policy 45–58.
Hensher, D.A., Mulley, C., Yahya, N., 2010. Passenger experience with quality-enhanced bus service: the tyne and wear 'superoute'services. Transportation 37, 239–256.
Kraus, S., Ribeiro-Soriano, D., Schüssler, M., 2018. Fuzzy-set qualitative comparative analysis (fsQCA) in entrepreneurship and innovation research–the rise of a method. Int. Entrepreneurship Manage. J. 14, 15–33.
Kroes, E.P., Sheldon, R.J., 1988. Stated preference methods: an introduction. J. Trans. Econ. Policy 11–25.
Lättman, K., Friman, M., Olsson, L.E., 2016. Perceived accessibility of public transport as a potential indicator of social inclusion. Social Inclusion 4, 36–45.
Mackie, J.L., 1965. Causes and conditions. Am. Philos. Quart. 2 (4), 245–264.
Marcucci, E., Gatta, V., 2007. Quality and public transport service contracts. Eur. Transport 36, 92–106.
Mcfadden, D., 2001. Economic choices. Am. Econ. Rev. 91, 351–378.
Miranda, S., Tavares, P., Queiró, R., 2018. Perceived service quality and customer satisfaction: A fuzzy set QCA approach in the railway sector. J. Bus. Res. 89, 371–377.
Misangyi, V.F., Greckhamer, T., Furnari, S., Fiss, P.C., Crilly, D., Aguilera, R., 2017. Embracing causal complexity: The emergence of a neo-configurational perspective. J. Manage. 43, 255–282.
Oliver, R.L., 1980. A cognitive model of the antecedents and consequences of satisfaction decisions. J. Mark. Res. 17, 460–469.
Oliver, R.L., 2010. Customer Satisfaction. Wiley International Encyclopedia of Marketing.
Oliver, R.L., Desarbo, W.S., 1988. Response determinants in satisfaction judgments. J. Consumer Res. 14, 495–507.
Olsson, L., Friman, M., Lättman, K., Fujii, S., 2020. Travel and life satisfaction-From Gen Z to the silent generation. J. Transport Health 18, 100894.
Olsson, L.E., Friman, M., Pareigis, J., Edvardsson, B., 2012. Measuring service experience: Applying the satisfaction with travel scale in public transport. J. Retailing Consumer Services 19, 413–418.
Olsson, L.E., Gärling, T., Ettema, D., Friman, M., Fujii, S., 2013. Happiness and satisfaction with work commute. Soc. Indic. Res. 111, 255–263.
Ordanini, A., Parasuraman, A., Rubera, G., 2014. When the recipe is more important than the ingredients: A qualitative comparative analysis (QCA) of service innovation configurations. J. Service Res. 17, 134–149.
Prioni, P., Hensher, D.A., 2000. Measuring service quality in scheduled bus services. J. Public Transport. 3, 51–74.
Ragin, C.C., 2000. Fuzzy-Set Social Science. University of Chicago Press.
Ragin, C.C., 2008. Redesigning Social Inquiry: Fuzzy Sets and Beyond. Wiley Online Library.
Ragin, C.C., 2014. The Comparative Method: Moving Beyond Qualitative and Quantitative Strategies. Univ of California Press.
Ragin, C.C., Davey, S., 2016. Fuzzy-Set/Qualitative Comparative Analysis 3.0. Department of Sociology, University of California, Irvine, California.
Redman, L., Friman, M., Gärling, T., Hartig, T., 2013. Quality attributes of public transport that attract car users: A research review. Transp. Policy 25, 119–127.
Rihoux, B., Ragin, C.C., 2008. Configurational comparative methods: Qualitative comparative analysis (QCA) and related techniques. Sage Publications.
Russo, I., Confente, I., Gligor, D., Cobelli, N., 2019. A roadmap for applying qualitative comparative analysis in supply chain research. Int. J. Phys. Distrib. Logist. Manage.
Schneider, C.Q., Wagemann, C., 2012. Set-Theoretic Methods for the Social Sciences: A Guide to Qualitative Comparative Analysis. Cambridge University Press.
Sihvonen, A., Pajunen, K., 2019. Causal complexity of new product development processes: a mechanism-based approach. Innovation 21, 253–273.
Singleton, P.A., 2019. Validating the Satisfaction with Travel Scale as a measure of hedonic subjective well-being for commuting in a US city. Transport. Res. Part F: Traffic Psychol. Behav. 60, 399–414.
Sukhov, A., Sihvonen, A., Netz, J., Magnusson, P., Olsson, L.E., 2020. How experts screen ideas: The complex interplay of intuition, analysis and sensemaking. Accepted Author Manuscript J. Product Innov. Manage.. https://doi.org/10.1111/jpim.12559.
Sukhov, A., Sihvonen, A., Olsson, L.E., Magnusson, P., 2018. That makes sense to me: Openness to change and sensemaking in idea screening. Int. J. Innov. Manage. 22(08), 1840009.
Susilo, Y., Abenoza, R., Woodcock, A., Liotopoulos, F., Duarte, A., Osmond, J., Georgiadis, A., Hrin, G., Bellver, P., Fornari, F., 2015. Findings from measuring door-to-door travellers' travel satisfaction with traditional and smartphone app survey methods in eight European cities. International Conference on Travel Behaviour Research (IATBR 2015), Windsor, UK, 2015. 19-23.
Susilo, Y.O., Cats, O., 2014. Exploring key determinants of travel satisfaction for multi-modal trips by different traveler groups. Transport. Res. Part A: Policy Practice 67, 366–380.
SWECO, 2014. Attitude- and Travel Habit Survey in Värmland 2014. https://regionvarmland.se/globalassets/global/utveckling-och-tillvaxt/hamta-material/ovriga-rapporter/slutrapport_rvu_varmland_2014.pdf Retreived on 2020-11-25.
Van Lierop, D., Badami, M.G., El-Geneidy, A.M., 2018. What influences satisfaction and loyalty in public transport? A review of the literature. Trans. Rev. 38, 52–72.
Verhoef, P.C., Lemon, K.N., Parasuraman, A., Roggeveen, A., Tsiros, M., Schlesinger, L.A., 2009. Customer experience creation: Determinants, dynamics and management strategies. J. Retail. 85, 31–41.
Westbrook, R.A., Oliver, R.L., 1991. The dimensionality of consumption emotion patterns and consumer satisfaction. J. Consumer Res. 18, 84–91.
Woodside, A.G., 2013. Moving beyond multiple regression analysis to algorithms: Calling for adoption of a paradigm shift from symmetric to asymmetric thinking in data analysis and crafting theory. J. Bus. Res. 66 (4), 463–472.
Woodside, A.G., Schpektor, A., Xia, X., 2013. Triple sense-making of findings from marketing experiments using the dominant variable based-logic, case-based logic, and isomorphic modeling. Int. J. Bus. Econ. 12.