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Street-space reallocation in the Oslo city center: Adaptations, effects, and consequences

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ABSTRACT

Cities worldwide reallocate street space from serving cars to other modes and uses as part of strategies to make their city centers attractive, vibrant, and accessible. Novel empirical knowledge may reduce uncertainties and opposition to implementation. This article contributes insights into how commuters and city center users adapted to rapid and radical street reallocations in the Oslo city center and the effects and consequences they experienced. Extensive surveys were conducted before and after realization; the results showed weak but positive results for the issues investigated, such as commute satisfaction, experienced accessibility, frequency of visits, and appreciation of the city center. Travel experiences improved for those walking and bicycling, whereas they worsened for those driving. The results showed only minor modal changes. The interventions contributed positively to factors attracting visitors, and thus, the findings might expand authorities' understanding of feasible interventions when developing more sustainable and people-friendly cities.

1. Introduction

Cities worldwide seek to develop their city centers to make them more attractive, vibrant, and accessible. This objective is often motivated by the following desires: to offer inhabitants a pleasant city center they appreciate and use; to facilitate suitable environments for retail, services, and other commercial and noncommercial activities; to attract businesses and inhabitants to the city; and to shift urban mobility toward more sustainable modes (see, for instance, Ajuntament de Barcelona, 2015; City of Paris, 2020; Madrid City Council, 2017; Municipality of Helsinki, 2013; Municipality of Oslo, 2018a, 2018b, 2018c; Oslo Arbeiderparti et al., 2015, 2019; UN, 2017). There is a growing understanding that reallocating street space from driving and parking cars to other modes and uses needs to be part of the solution to attain these objectives. However, there are concerns that often hamper such initiatives. These include that the negative impact of reduced car accessibility might be more substantial than the positive impacts of better accessibility by other transport modes and more pleasant environments (Cairns et al., 2002). Furthermore, resulting in less attractive and vibrant city centers.

The objective of this research is to develop empirical understandings of user groups' adaptations to and the effects and consequences of street-space reallocations in city centers, providing insights relevant to developing more sustainable and people-friendly city centers and cities. Previous research has documented that permanent and temporary interventions in city center streets and plazas that favor pedestrians cause greater use and visits, more people walking and biking, reduced traffic volumes, positive impacts on

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social interactions and health, increased retail turnover, and higher rental prices (Bertolini, 2020; Burden and Litman, 2011; Cairns et al., 2002; Carmona et al., 2018; Gehl Architects, 2014; Gehl and Gemzøe, 1996; Gössling et al., 2016; Hass-Klau, 1993; Keserü et al., 2018; Lawlor, 2012; Melia and Shergold, 2018; Nieuwenhuijsen and Khreis, 2016; Sadik-Khan and Solomonow, 2017; Szarata et al., 2017). Some of these studies focus on rather circumscribed interventions (e.g., changes to one or a few streets) and their effects in nearby areas (Melia and Shergold, 2018; Szarata et al., 2017). Others focus on experimental rather than permanent changes (see Bertolini, 2020, for a literature review); they may not provide a sound knowledge base for cities considering more substantial interventions with the potential to affect the whole city center. Gehl and Gemzøe's (1996) examination of how public life developed from 1968 to 1996, in tandem with a substantial part of Copenhagen's city center becoming more pedestrianized, is one example of research covering the effects of quite radical changes over a long period. These researchers found that the increased use of the city center was similar (in proportion) to the increase in square meters of car-free area (about 3.5 times as many users and 3.5 times as much pedestrian space).

A study from Brussels addresses the impact of the pedestrianization of central boulevards and changes in public transport and parking facilities, interventions with the potential to affect the whole city center (Keserü et al., 2018). This study is the only one that we are aware of investigating impacts using city-wide surveys with inhabitants in the metropolitan area, surveys among employees working in or near the pedestrian zone, and interviews with visitors to the area. It addresses changes in modal choice, accessibility, and perception of public space. The key findings indicate a potentially significant increase in public transport usage; both residents and employees visit less frequently, and the main reasons for both less and more frequent visits include changes in perceived accessibility and attractiveness. One reported reason for visiting more seldom is parking difficulties. In the collected data, car drivers express that accessibility had worsened because of the changes. At the same time, the satisfaction with public-transport accessibility is quite positive and mainly unchanged. The level of support for car-free boulevards varies across the types of users, but overall, the proportion of supporters exceeds that of non-supporters. Still, the Brussels study is limited in that it addresses only the period during implementation and lacks a baseline survey, reducing its credibility in offering a pathway for difficult deliberations about city center interventions.

The limited scope of former studies means that cities considering more radical shifts in accessibility and redistribution of car space to other modes and uses have a relatively scarce knowledge base to lean on when rapidly implementing such schemes. This lack of insight may result in uncertainty, resistance, and conflict when authorities suggest street-space reallocation and reduce private cars' access to city center streets or parking spaces. Furthermore, it can hamper the shifts toward more sustainable and people-friendly cities. It also increases the risk that authorities will implement changes and measures that do not have the desired effects or have unforeseen negative consequences.

This article contributes to the existing literature with a thorough and longitudinal study of how commuters to and users of Oslo city center adapted to radical and rapid reallocations of street space from cars to other modes and uses from 2017 to 2019, as well as what effects and consequences they experienced. The city authorities' motivations for making these changes were developing a more vibrant, enjoyable, pleasant, and lively city center, facilitating more public life, accelerating the shift from private cars to other modes, and reducing greenhouse gas emissions. Key data sources are surveys conducted before, during, and after the implementation of interventions. Impacts on the city center are discussed based on the findings from the surveys and supplementary data. Freed-up traffic space enabled widened sidewalks, pedestrianization, greeneries, outdoor seating, and more vibrant public life, among other things. The rapid implementation offered an excellent opportunity for research and knowledge generation, with the short timespan reducing the influence of other dynamics in the center and the city. We consider the interventions radical, both in terms of the *rapid* implementation of *multiple and larger* changes prioritizing pedestrians, cyclists, and city life instead of cars, and in the sense that such interventions are often highly *debated*.

In this paper, the city center interventions are primarily understood and investigated as changes in the transport system, focusing on how they have affected travel behavior and travel experiences among commuters and city center users, which includes how respondents use and perceive the city center. The key interventions include removal of approximately 760 on-street parking spaces (mainly visitor parking), reuse of the spaces for other modes and purposes, and a new driving pattern introduced to reduce car driving and prevent through-traffic (see Section 2 for details and the timeline of interventions). We investigate how commuters and city center users respond to the simultaneous changes. The findings contribute novel knowledge because few previous studies have taken this position. However, we do not study how interventions have affected city center residents. Since the area is still accessible by car and residents' parking has not been altered, we think that the few city center residents in the area are less affected. The work aims to contribute to the knowledge base, informing planners, policymakers, and authorities in Oslo and other cities considering similar interventions of ways to develop their cities in more sustainable and people-friendly directions.

Previous research has documented that absolute and relative qualities of the transport systems affect how people travel. Several studies focusing on the competitiveness between different transport modes have documented that improving the quality of one mode over another tends to result in more people starting to use the improved mode of transport (Bertolini, 2020; Cairns et al., 2002; Downs, 2004; Fishman et al., 2014; Forsyth and Krizek, 2010; Goodwin, 1996; Hillnhütter, 2016; Mogridge, 1997; Noland and Lem, 2002; Pucher et al., 2010; Pucher and Buehler, 2010; Redman et al., 2013; Tennøy et al., 2019; Walker, 2012). When street space was reallocated in the Oslo city center, the conditions for car usage worsened while those for using other modes improved. These accessibility changes could be expected to result in modal changes toward lower proportions of commuters and city center users traveling to and in the city center by car.

The changes in accessibility by different modes, and the expected modal changes, could affect the time spent traveling to the city center for those commuting or visiting for other purposes. Removal of on-street parking could affect the time spent searching for parking. Changed accessibility of a destination, either across the board or for preferred modes of transport, may affect the destination

choice (Cairns et al., 2002). For instance, changes in actual and perceived accessibility could alter how often city center users visit the center, what they do when visiting it, and how much money they spend. Accessibility is also crucial for businesses needing to attract employees from the larger urban region. Significant accessibility changes to the city center and commute satisfaction could result in either more or fewer employees and businesses wanting their offices located here. Since commuting trips are usually less flexible than other trips, changes in commute quality and satisfaction could also have wider consequences for commuters' daily activities, health, and subjective wellbeing (Chatterjee et al., 2020). Thus, changes in accessibility have the potential to strongly affect the vitality and vibrancy of the city center because people working and visiting there are needed to populate streets, parks, and plazas and contribute to the turnover for retail and service businesses.

A key intention of street-space reallocation from parking and driving to other modes and uses in Oslo was to make the city center more enjoyable and to improve walking and bicycling experiences. As discussed above, previous studies have documented that street-space reallocation has many positive impacts (for reviews, see Bertolini, 2020; Soni and Soni, 2016). The current study asks whether the interventions affected city center users' experience of traveling in the city center by different modes, what they do and do not appreciate there, and how enjoyable they find the center.

Suggestions for reallocating road and street space to other uses are often loudly debated in the press and social media, and those opposing the changes often dominate the picture. The debates might increase uncertainty and opposition, such that city authorities abandon plans and interventions that would otherwise help them achieve their goals of making the city more attractive and sustainable. Several studies have revealed 'silent' public support for schemes involving street-space reallocation (Gundlach et al., 2018; Keserü et al., 2018; Sustrans, 2020; Transport and Environment, 2020). The findings show that acceptance is higher among frequent visitors to such areas, among those living close by or centrally (Keserü et al., 2018), and if car restrictions are combined with improved conditions for cyclists and public transport and recreational uses of the freed space (Gundlach et al., 2018). Despite considerable resistance to the process of pedestrianization, especially among retail businesses, acceptance and positive endorsement often follow implementation (Hass-Klau, 1993, 2015; Melia, 2015, Szarata et al., 2017). In Oslo, too, the debate was dominated by those opposing the interventions (Naper and Moland, 2017; Rydningen et al., 2017; Wylie, 2019), with discussions on, among other things, the trade-offs between accessibility, frequency of visits, and the desirability for running businesses in the city center. Some claimed that reduced accessibility by car would prevent people from traveling there and instead choose other destinations, and this effect could reduce the city center's attractiveness. We used the opportunity of the study to ask respondents how they expected the interventions would affect the use of the city center in general and how it affected their use. The results contribute more empirical knowledge on the attitudes and understandings of the (often) silent majority to the literature; such knowledge can be valuable when discussing these kinds of interventions.

Section 2 describes the case area of Oslo city center and the interventions taking place there in 2017–2019. Section 3 then presents the research design, methodology, and data. In Sections 4 and 5, the findings are presented and discussed, and the paper closes with concluding remarks in Section 6.

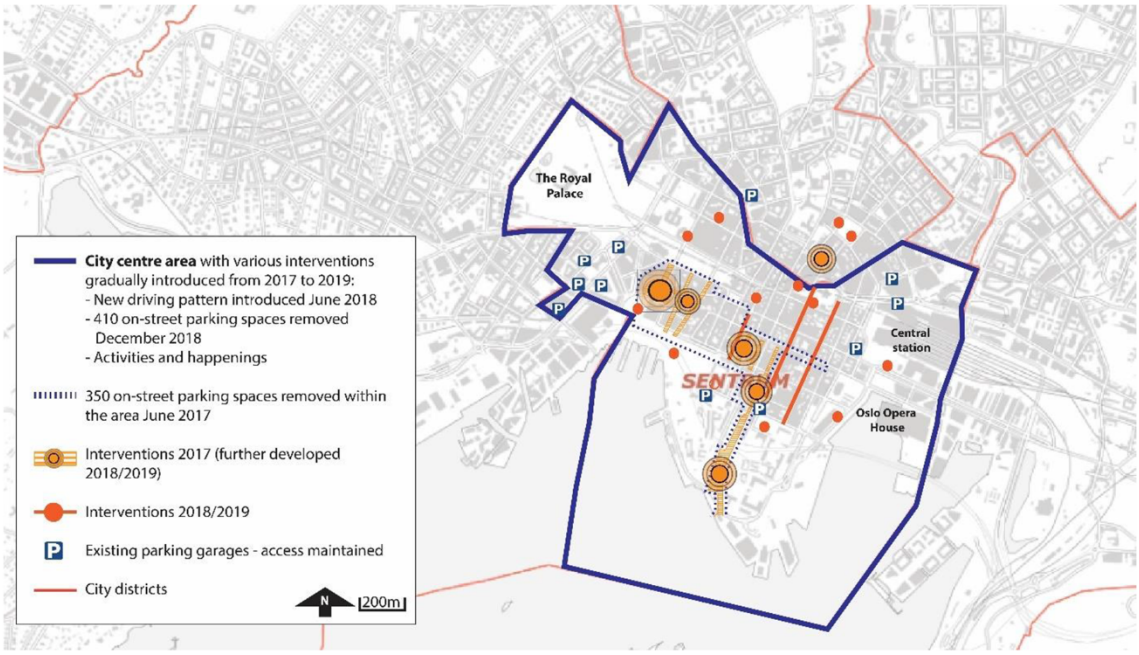

Fig. 1. City center area as defined in the study and distribution of key interventions implemented from 2017 to 2019.

2. Case: Street-space reallocation in Oslo city center

In late 2015, the newly elected City Government introduced plans for street-space reallocation in the Oslo city center through their City Council Declaration; the implementation started in 2017. As mentioned above, the key motivations were to achieve a more vibrant, enjoyable, pleasant, and lively city center; facilitate the use of other transport modes than private cars; and reduce greenhouse gas emissions from transport (Oslo Arbeiderparti et al., 2015). The administrative limit of the city center area (approximately 1.8 km^2) is illustrated in Fig. 1; the area covers large parts of Oslo's central business district. Table 1 presents an overview and timeline of the key interventions implemented in 2017 to 2019 that are studied in this paper. The interventions' localizations in the city center are illustrated in Fig. 1.

Car-restricting interventions include a stepwise removal of approximately 760 out of 1,450 on-street parking spaces (mainly visitor parking requiring payment and with time restrictions) and introduction of a new driving pattern in June 2018 to reduce car driving and prevent through-traffic in the city center. Car driving is still allowed in most streets. Car access to, among other things, the central station and existing private and public parking garages in the area has been retained. The capacity of these parking garages was not altered in the investigated period, meaning that about 90 percent of the city center's parking capacity remained unchanged. Nevertheless, the freed-up traffic spaces allowed for temporary and permanent street-use changes, including urban furnishing and parklets, wider sidewalks, new bike lanes, a new pedestrian street and parking reserved for freight deliveries, people with disabilities, tradespeople, and services. Some of these changes are illustrated in Figs. 2 and 3. The described interventions could be put into action in accordance with the then existing zoning plans. Because of these interventions and other changes, construction works caused reduced access to and use of some city center streets and plazas. Additional measures are planned and will continue over the next years, with a new city center zoning plan, approved in 2019, setting guidelines for further development of streets and plazas (Municipality of Oslo, 2018c).

Oslo city center is the dominant central business district in the relatively monocentric urban area of Greater Oslo. More than 1.5 million inhabitants live in Greater Oslo, with about 681,000 within the borders of Oslo (per 2019). Among the latter, 38 percent (260,000) live in the inner city within walking and cycling distance of the city center. Only about 1,400 people live in the city center of Oslo as defined here. In 2019, about 8,450 businesses were registered, and approximately 71,500 employees worked in the city center (Municipaity of Oslo, 2021). The city center offers shopping and services, and many office workplaces are located here.

The percentage of trips to the city center made by car is low, and most people travel there by public transport (as discussed in Section 4). Public transport accessibility is excellent, while car traffic in the city center's streets has gradually declined over the last 30 years, with through-traffic diverted to main roads outside or under (tunnels) the city center and the introduction of toll roads. In 2016, before the studied interventions were implemented, the calculated average annual daily traffic (AADT) on the city center's main streets was 33,100 vehicles, with AADT per street varying from 800 to 5,800 vehicles (Naper and Moland, 2017).

Contemporaneous with the described interventions studied here, other transport-system changes occurred in Oslo. Changes taking place outside the city center included upgrading of multiple inner-city tram lines and some city metro lines, new bicycle infrastructure across the city, and temporary main-road capacity reductions. These interventions have a high potential to affect accessibility to the city center using different transport modes. In addition, a new parking scheme was introduced in the inner city, implementing charged parking for residents and visitors. Responses to these changes are not addressed in this study, but they are worth mentioning as context.

3. Research design, methodology, and data

Designed as a single, longitudinal case study, the reallocation of street space and other interventions in the Oslo city center were examined as the case. The aims of the research were to document and understand the adaptations to and effects and consequences of the described interventions for commuters and city center users. A case-study design allows studies of contemporary phenomena that the researchers have no control over in their real-life context (Flyvbjerg, 2006; Stake, 1995; Yin, 2003). This design is particularly relevant in situations where the boundaries between context and phenomena are not clearly separated and where the number of

Table 1
Overview and timeline of key interventions in the city center from 2017 to 2019.

2017[a]	2018	2019[b]
350 on-street parking spaces removed in June Various interventions in six pilot areas[c] (e.g., urban furnishing, parklets, art installments, flowers) Various activities and events	New driving pattern introduced in June 410 on-street parking spaces removed in December Various temporary and permanent interventions on former on-street parking spaces[c] (e.g., wider sidewalks, playground, urban furnishing, parklets, art installments, illumination, flowers) Various activities and events	Various temporary and permanent interventions for former on-street parking spaces[c] (e.g., wider sidewalks, urban furnishing, parklets, art installments, illumination, flowers) New pedestrian street in construction[b] Various activities and events

[a] Described interventions implemented after the 2017 survey.
[b] Described interventions implemented before the 2019 survey except the pedestrian street, which was still in construction and was finished later that year.
[c] Interventions have been implemented in the following street/places in the city center: Øvre Slottsgate, Nedre Slottsgate, Møllergata, Kongens gate, Tordenskiolds gate, Rosenkrantz' gate, Fridtjof Nansens plass, Dronningens gate, Myntgata 2, Olav Vs plass, Kontraskjæret, Youngstorget, Domkirkeparken, Rådhusgata, Kirkegata, Grev Wedels plass, Christian Frederiks plass, Langkaia and Olav Vs gate.

Fig. 2. Examples of the temporary interventions on the locations of former on-street parking spaces. Top left: The situation before removal of on-street parking in Møllergata. Top right: Benches and flowerpots have replaced parking spaces in Møllergata. Bottom left: Parking space and a wide driving area in Kongens gate. Bottom right: Parking in Kongens gate replaced by the street art piece "Shall We Dance" by artist Marisa Ferreira. Photos: Oddrun Helen Hagen.

relevant variables is high. This was the situation here, as illustrated in the case description in Section 2.

The choice of case could be understood as strategic (Flyvbjerg, 2006; Yin, 2003) in that the interventions could be expected to make commuters and city center users adapt and experience effects and consequences. Because of the low number of residents in the city center and the lack of changes to their car access and parking in garages, we did not expect residents to be similarly affected and do not study how residents respond to the changes. The case was understood as a natural experiment that offered a unique opportunity to investigate the phenomenon of "reallocation of street space from cars to other uses in city centers" and produce relevant knowledge. We did not attempt to distinguish between what interventions caused what adaptations, effects, or consequences, as we understood that these results would be brought about by the simultaneous changes together (e.g., that on-street parking was removed *and* the freed-up space reallocated to other uses).

The main data collection methods were surveys, document studies, and photo-documentation. As part of the larger project to which this article belongs, surveys were distributed every May/June from 2015 to 2019 to employees working in businesses located within the borders of Oslo municipality and eastern parts of Bærum (the neighboring municipality, housing a large business district). Questions concerned respondents' commutes and commute satisfaction, as well as how respondents adapted to various ongoing changes in the transport systems and what effects and consequences they had experienced. In 2017, 2018, and 2019, the surveys included questions regarding the interventions in the Oslo city center. The 2017 survey (and the previous ones) represents the baseline situation *before* the first changes described in Section 2 were implemented. At the time of the 2018 survey, the first stage of on-street parking removal had been conducted, and a temporary reuse of former parking spaces had been introduced. Both the second stage of on-street parking removal and the new driving pattern were presented after the 2018 survey and before the 2019 survey. The interventions described in Table 1 had been implemented at the time of the 2019 survey. Hence, the 2019 survey represents the situation *after* street-space reallocations were realized. However, construction work in the city center was still affecting accessibility in the area at this time.

Using geocoded information from the Central Register of Enterprises (Statistics Norway), invitations to participate in the yearly surveys were sent to representatively distributed companies in the defined geographical area. The companies were of various sizes and randomly selected; a new selection was made each year. Companies agreeing to participate could provide us with employees' email addresses to send them the questionnaires directly; alternatively, they could share a questionnaires link to their employees by email or intranet. Given these options, we do not know whether the sample of respondents is representative of those invited to participate or of employees working in companies located in the defined area. We do not have information about the characteristics of the total universe of those invited. Hence, we are also unaware of whether there are any systematic patterns regarding who participated and who did not. These limitations were known when designing the study, which did not aim at statistical generalization. We know the respondents' workplace locations, and the sample is representative concerning such locations in the relevant geographical area. High numbers of

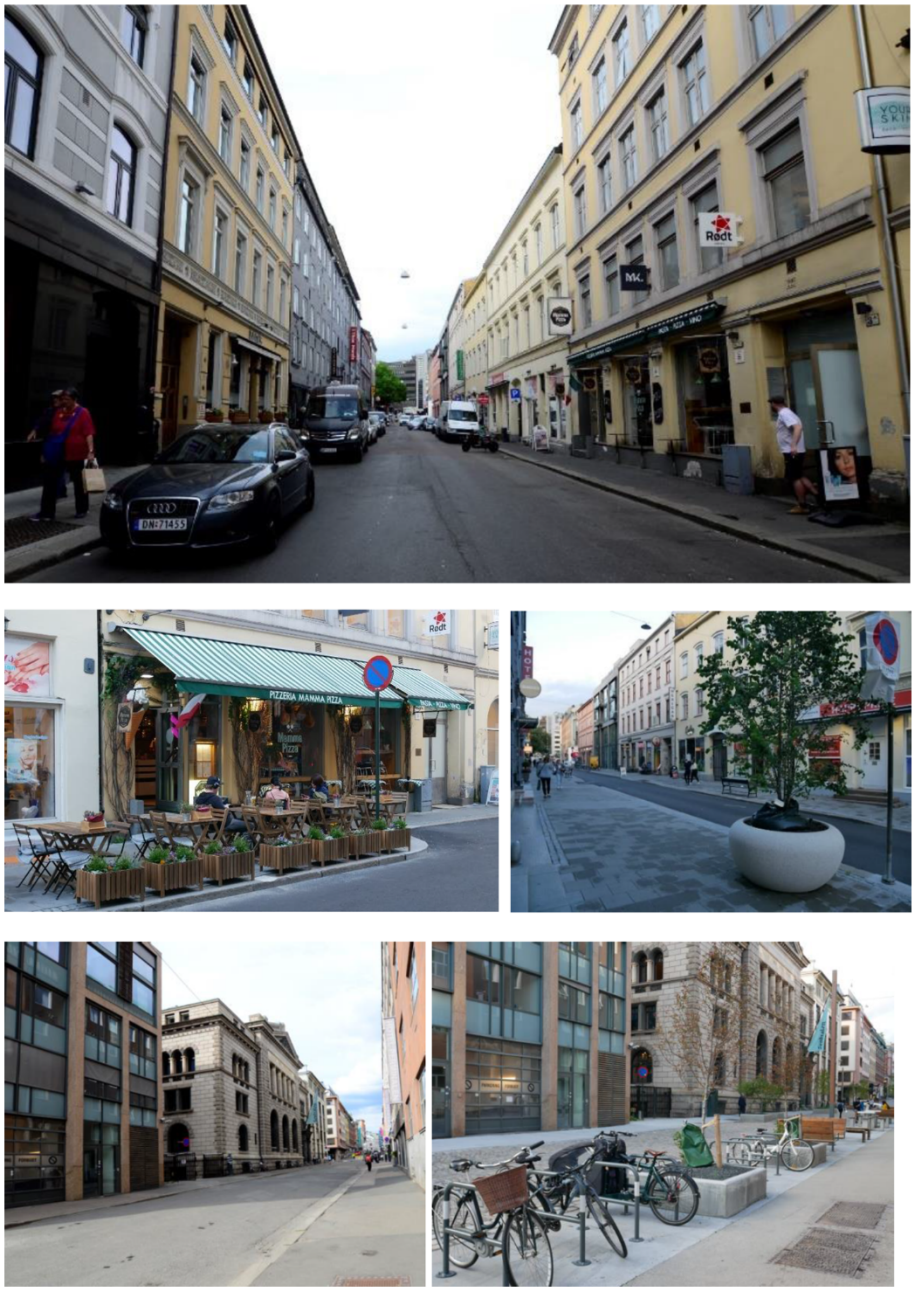

Fig. 3. Examples of permanent interventions on former on-street parking spaces. Top: The street of Dronningens gate before interventions. Middle left and middle right: Extended sidewalks and narrowed driving area in Dronningens gate. Bottom left: The street of Øvre Slottsgate before interventions. Bottom right: Øvre Slottsgate turned into a new pedestrian street. Photos: Oddrun Helen Hagen.

respondents answered, varying from n = 4,270 (2015) to n = 6,768 (2016). In this article, we refer to two different subsamples drawn from the surveys. One is the subsample "city center users," including respondents who said they visited the city center in the past year outside of work-related trips. For this sample, we use survey data for 2017, 2018, and 2019 (n = 5,457–6,018 respondents). The other subsample referred to includes those working in the city center as defined in this study (see Fig. 1), and we use data from the surveys done every year from 2015 to 2019 (n = 548–1,611 respondents). The characteristics of the respondents in the samples are reported in Appendix A. We find that the distribution related to gender, age, income, and more is similar each year, and thus, the results are comparable. The "Oslo sample" is sometimes mentioned in the paper, referring to all respondents in the surveys. Frequency analyses and cross-tabulations were conducted in the surveys for each year and used in analyses across years to describe the development of relevant issues. Survey questions and a summary of data included in the article are provided in Appendix B (commuters) and Appendix C (city center users).

The document studies included reading municipal strategies and plans related to the city center interventions and surveys and analyses conducted by consultants on behalf of the City. These sources were used in describing objectives, strategies, interventions, and timelines, as well as in discussions of the findings. The situations before and after the street-space reallocation were thoroughly photo-documented, helping us understand and recollect the extents of the changes.

Initially, it was planned to use data from electronic traffic counters to examine how interventions and adaptations affected the number of cars and bicycles in the city center streets. However, this approach was abandoned because of the limited number of counters and their non-optimal locations, as well as uncertainty concerning data quality.

4. Findings

4.1. City center commuters

Survey data from 2015 to 2019 were analyzed to investigate the following: *i)* whether city center commuters adapted to the reallocation of street space from driving and parking to other uses by shifting travel behavior, *ii)* what effects they experienced respecting commuting time and parking access, and *iii)* whether they experienced consequences in terms of changes in commute satisfaction. When accessibility by car was reduced and that by other means of travel was improved, it was expected that the real-location of street space would make some commuters *adapt* by shifting from commuting as car drivers to other transport modes. In all the surveys, we asked, *"By which transport mode did you travel the longest the last time you traveled to work and met where you usually meet?"* We found only weak changes in modal choice on commutes in the years investigated. As shown in Fig. 4, most commuted by public transport, varying from 65 percent in 2018 to 73 percent in 2017. Walking shares increased every year (from 6% in 2015 to 10% in 2019), and they were higher than car-driver shares (varying from 4% in 2017 to 7% in 2019). From before (2015, 2016, and 2017) to after the interventions took place (2018 and 2019), public transport usage decreased, while walking and biking increased. Car shares were already low before the interventions were implemented. Despite the car restrictions, we found that car usage on commutes increased. As we return to below, the changed access to parking offered by employers may explain this (see Fig. 5).

We asked, *"Do you commute differently now as compared to this time last year?"* Each year, 21 to 26 percent of the commuters responded "yes." The results are included in Appendix B. Various changes were reported. Four to seven percent of respondents stated that they used public transport more frequently. Three to six percent biked more often. The share using a car more often was equal to the share using it less frequently (2% each year). Among those traveling differently, most stated that the desires for more daily exercise (13% in 2019) and reduced travel time (12% in 2019) as reasons.

One potential effect of the intervention in the city center was the changed time used on commutes. The results showed only small variations in commuting time from year to year, both in total (varying from 39 min in 2017 to 41 min in 2018 and 2019) and per transport mode, and no systematic increase or decrease was observed when comparing the situation before and after implementation of the city center interventions. The average commuting time varied from 25 min (2017) to 29 min (2018) for those on foot, 25 min (2017) to 28 min (2018 and 2019) for those biking, 43 min (2017) to 47 min (2018) for those using public transport, and 33 min (2018) to 38 min (2019) for those driving a car. The results are included in Appendix B. Another potential effect was altered access to parking. We asked whether the commuters could park at or near their workplaces and analyzed how this changed (Fig. 5). As expected, the proportion of respondents answering that they could park in the street decreased from 14 percent in 2016 to 4 percent in 2019 after the removal of on-street parking. More interesting is the proportion answering they could park for free or a charge in parking spaces offered by their employers, which increased by 21 percentage points from 2017 (23%) to 2019 (42%). Nineteen percent of respondents in 2017 and 36 percent in 2019 could park in their employer's parking for free. This is further discussed later in the section.

The potential wider *consequences* investigated were changes in commute satisfaction. We asked, *"How satisfied are you with your commute based on how you normally travel?"* (Fig. 6). Commuters working in businesses in the city center were generally satisfied with their commutes, with the share answering they were "very satisfied" or "satisfied" varying from 75 percent in 2015 and 2018 to 79 percent in 2016, 2017, and 2019. Few were dissatisfied with their commute (around 11% each year). Analyzing commute satisfaction among users of different modes of transport (see Appendix B) revealed that those walking were more satisfied, with the proportions answering "very satisfied" or "satisfied" varying from 86 percent (2018) to 96 percent (2017). Those biking were the second most

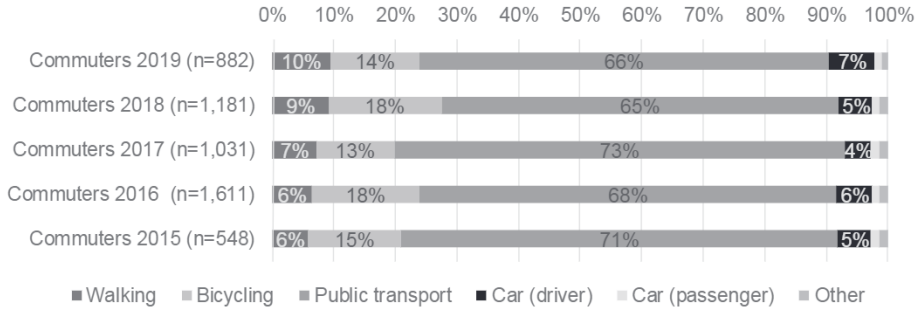

Fig. 4. Responses to the question, "By which transport mode did you travel the longest the last time you traveled to work and met where you usually meet?"

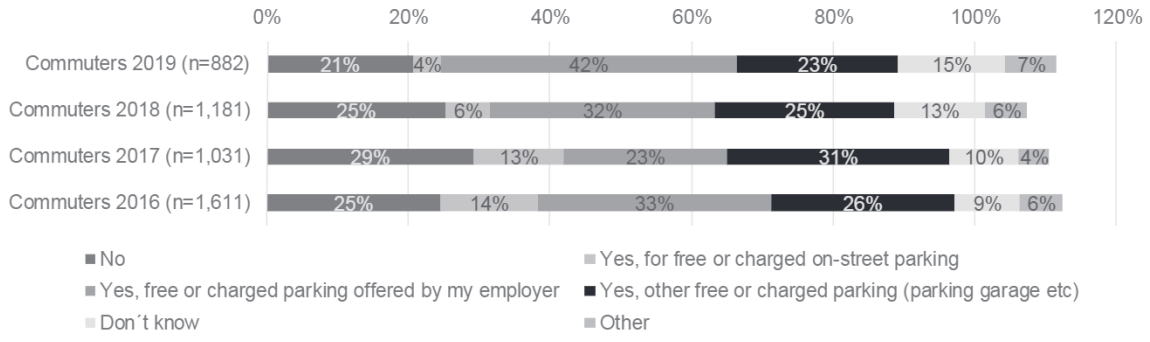

Fig. 5. Responses to the question, "If you are going to drive to work, do you have the opportunity to park at or near your workplace?". Respondents could select more than one answer. The question was not asked in 2015.

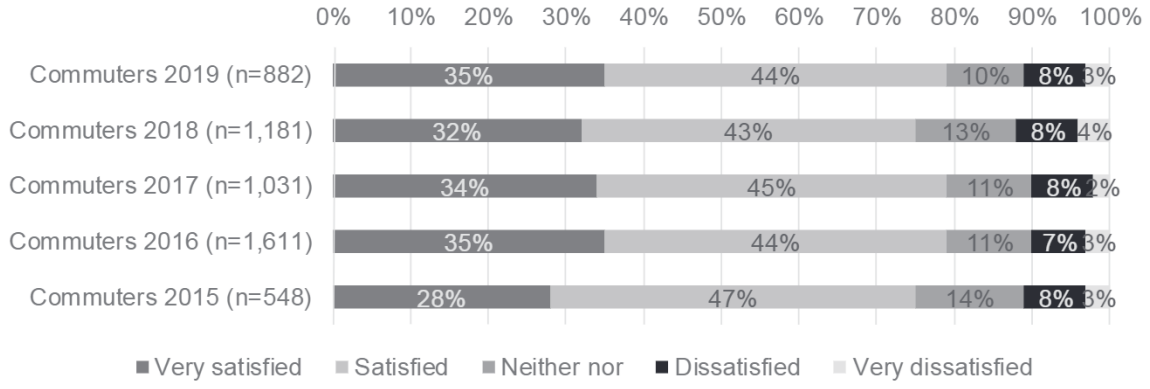

Fig. 6. Responses to the question, "How satisfied are you with the commute based on how you normally travel?"

satisfied, with shares answering "very satisfied" or "satisfied" varying from 77 percent (2015) to 88 percent (2019).

There were variations between years but no clear trend in commute satisfaction changes from before to after street-space reallocation. The findings are in line with those for the Oslo sample (commuters to workplaces in all of Oslo), where commute satisfaction was relatively stable and improved weakly over the five years, with many and different changes in the transport system.

More detailed investigations of changes in commute satisfaction revealed more substantial differences from the before situation to the after situation. When comparing answers from 2017 and 2019, those biking and those driving became more satisfied with their commute. Among car drivers (Fig. 7), the share answering "very satisfied" decreased from 35 percent in 2017 to 29 percent in 2019, while the share answering "satisfied" increased from 30 percent in 2017 to 47 percent in 2019. The shares of "dissatisfied" or "very dissatisfied" car drivers were relatively stable. The largest variations were found for the proportion of respondents answering "neither satisfied nor dissatisfied." Interestingly, the total share of car drivers who were "very satisfied" or "satisfied" increased from 65 percent

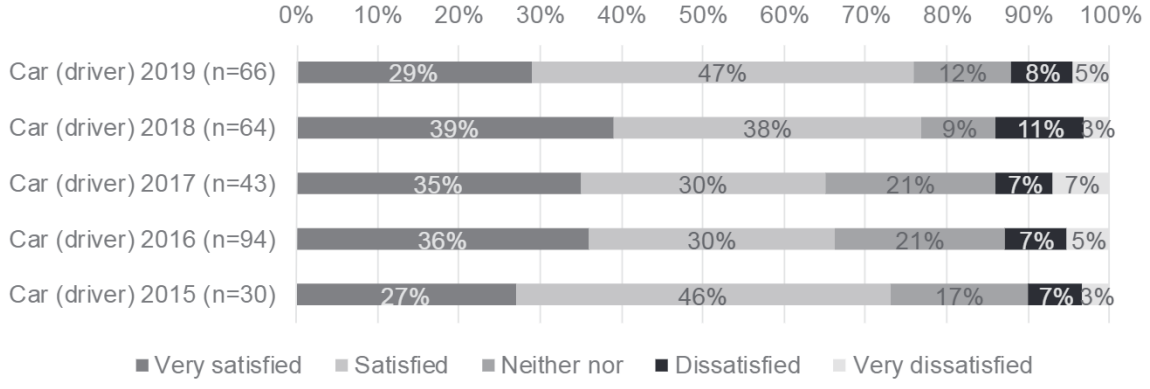

Fig. 7. Responses to the question, "How satisfied are you with the commute based on how you normally travel?" among those answering that they drove a car on their last commute.

in 2017 to 76 percent in 2019. The latter may be surprising given the reduced car accessibility. One explanation could be that those driving to work park in garages, not on the street, and they would not be affected by removal of the on-street-parking. We also found a significant increase in the proportion of commuters who replied that it is usually easy to find parking at or near their workplace from 2017 (22%) to 2019 (40%). As described above, there was also a significant increase in commuters who said they could park in parking spaces offered by their employers. This could also explain the increased car usage on commutes to the city center.

These somewhat surprising results could be related to city center businesses deciding to offer their employees parking to a greater extent than before to ensure that their employees did not change jobs as a response to the interventions and possibly reduced car accessibility. We did not investigate this hypothesis further.

4.2. City center users

Data from surveys conducted in 2017, 2018, and 2019 were used when analyzing whether city center users (respondents who have been in the city center the past year, excluding work and work meetings) reported the following: *i)* adapting to the city center interventions by changing their frequency of visits mode of transport when visiting; *ii)* effects related to parking accessibility, what they do in the city center, and how much money they spend; and *iii)* consequences related to experienced accessibility to the city center, traveling within the city center by different modes, and what they enjoy there. See Appendix C for data summaries.

It seems that city center users have not adapted by shifting their mode of transport. Asking city center users how they traveled the last time they visited the center (Fig. 8), we found that most traveled by public transport (varying from 66% in 2018 to 69% in 2019), followed by walking (11% all three years) and biking (varying from 7% in 2017 to 11% in 2019). Fewer traveled as car drivers (reducing from 9% in 2017 to 7% in 2019). In 2018 and 2019, both walking and biking shares were higher compared with the car driver shares. Comparing the situation before (2017) and after (2019) street-space reallocation, the changes were minor.

Investigating the frequency of visits to the Oslo city center, we found hardly any variation. Many city center users are already frequent visitors. More than 40 percent go there once or several times a week, and more than 80 percent visit several times a month. When comparing these answers to how they traveled the last time they visited, we found that those walking and biking visited the center most often. We found only marginal differences between how women and men answered.

The anticipated direct *effect* of street-space reallocation could be a more challenging parking situation because of on-street-parking spaces removal. We asked those who traveled by car on their last visit to the city center about parking; the results are given in Appendix C. As anticipated, the share saying they had used on-street parking decreased from 2017 (39%) to 2018 (30%) and again from 2018 to 2019 (29%). The use of parking garages increased from 32 percent in 2017 to 40 percent in 2018 and 2019, as did the share using private parking (from 12% in 2017 to 17% in 2018 and 16% in 2019). We found the highest variations when comparing 2017 and 2018, when on-street parking was restricted only to parts of the city center. The shares parking outside the center were stable, probably because charged parking was also implemented there. Most respondents took less than five minutes to park; however, the share using below five minutes decreased from 74 percent in 2017 to 63 percent in 2019. The average time used to find parking increased from approximately 5.5 min in 2017 to just over 7 min in 2018 and 2019. To sum up, as expected, the street-space reallocation made it somewhat more difficult for city center users to find parking.

The results showed no substantial changes from 2017 to 2019 in what city center users reported they did when visiting the city center (Fig. 10). Most cited “Restaurants, pubs, cafés” (43% in 2019) as the purpose of their visit, followed by “Shopping” (35% in 2019) and “Meeting friends” (27% in 2019).

Investigating changes in how much money city center users spent the last time they visited the city center, we found the average consumption to be NOK 812 per visit in 2017, NOK 755 in 2018, and NOK 883 in 2019 (not index linked). There was an annual increase in the average amount spent among those walking and biking, while among those using other modes, the amount varied. In addition, when accounting for the consumer price index, the respondents spent more money in 2019 than in they did 2017. (The consumer price index was 5% from 2017 to 2019). Those who biked spent less money per visit compared with those walking, and they both spent less than car drivers did. Average consumption varied from NOK 695 to NOK 739 for those walking, NOK 506 to NOK 611 for those biking, NOK 797 to NOK 875 for those using public transport, and NOK 1,057 to NOK 1,263 for those driving cars (not index-linked).

Wider *consequences* of the reallocation for city center users included changes in perceived accessibility to the city center, the experience of traveling by different modes of transport in the center, how much they enjoy it there, and what they appreciate. Investigating changes in perceived accessibility, we asked, *“How easy do you find it to get to the city center at this time of year?”* (Fig. 11).

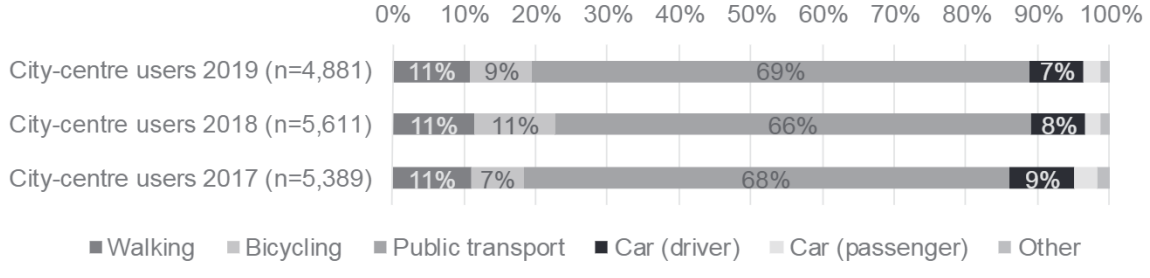

Fig. 8. Responses to the question, “How did you travel the last time you used the city center?”

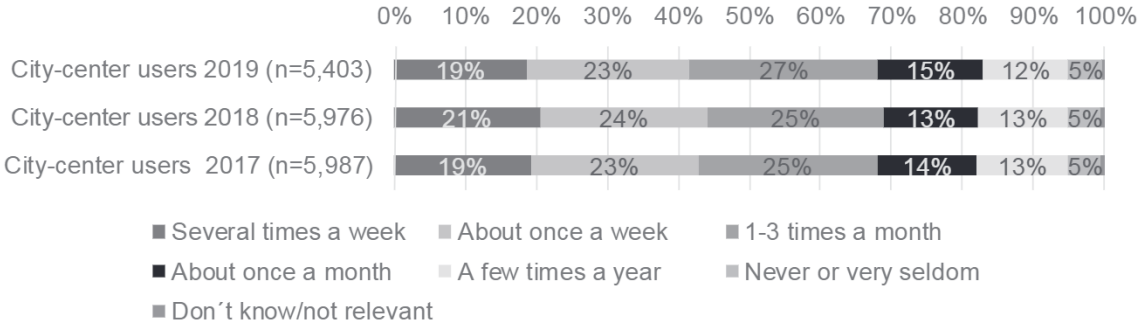

Fig. 9. Responses to the question, "How often do you visit the city center, excluding jobs and job meetings, at this time of year?"

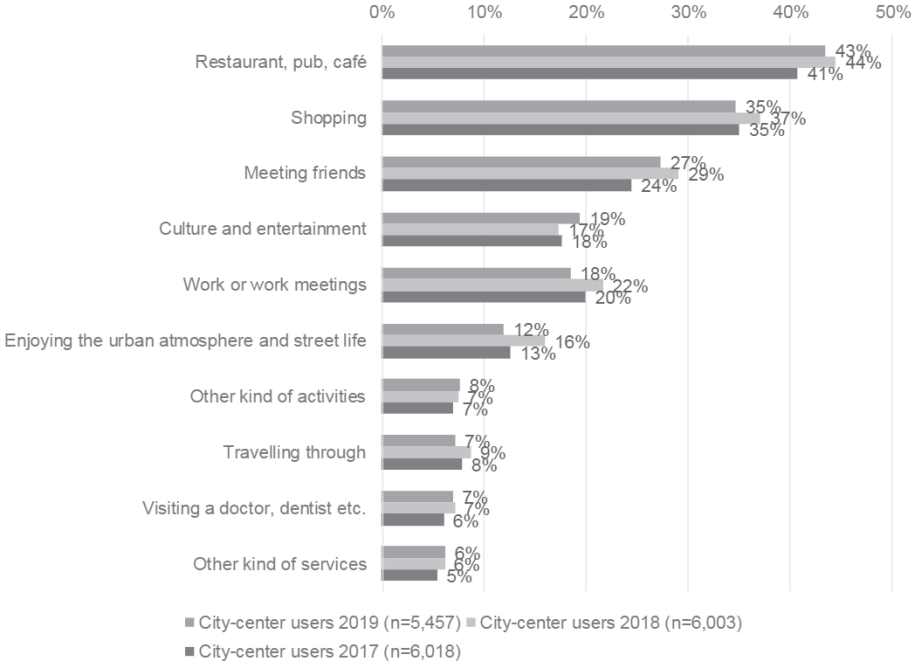

Fig. 10. Responses to the question, "What did you do on your last visit to the city center? Do not include the 17th of May [Norway's national day] if relevant. Specify all relevant activities." Ten most cited activities, sorted by distribution for 2019.

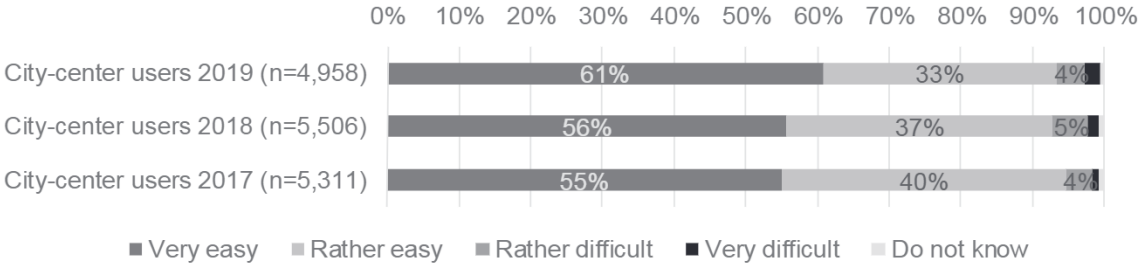

Fig. 11. Responses to the question "How easy do you find it to get to the city center at this time of year?"

In 2019, 94 percent of the city center users answered that it was "very easy" or "rather easy" to reach the city center, and this was similar to what they reported in the two previous years. From 2017 to 2019, there was an increase in respondents who answered, "very easy" (from 55% to 61%). This may indicate that the perceived accessibility to the city somewhat improved. Few (5%–7%) found it rather or very difficult access the city center.

Other consequences investigated were changes in the experiences of walking, biking, and driving in the city center. Participants responded to a battery of questions and statements concerning this topic, and some key tendencies are presented here. As expected, there was an increase in the proportion agreeing that the city center offered a good walking design and comfort after the street-space reallocation from driving and parking cars to other modes and uses. Because of bicycle interventions, both in the city center and city wide, we expected conditions for biking to improve. We found a small positive tendency showing that this had occurred. Yet, the results suggested that these conditions still need to be improved. City center driving was expected to become more difficult because of the interventions, and this was supported by the findings. Car drivers also reported being delayed and hindered by other road users; moreover, they experienced greater difficulty in wayfinding and found that there were too many restrictions and one-way streets. These changes may affect modal splits in the longer run.

Although street space has been reallocated from driving and parking to other uses, in 2018 and 2019, many still agreed that *"There is too much car traffic in the city center"* and *"Parked cars take up too much space*." However, as indicated in Fig. 12, the shares agreeing to these statements significantly decreased during the years investigated.

Changes in how much city center users enjoyed being in the center and what they appreciated and did not appreciate could also be affected by the interventions. More than 80 percent of the respondents answered that they enjoyed staying in the city center "very much" or "pretty much" for all the years investigated (Fig. 13). From the before to after situation, the proportion of respondents answering this way was quite stable, but the shares responding "very much" increased from 25 percent in 2017 to 29 percent in 2019. Very few did not like it there at all (2% for each year investigated).

When asking what city center users value most (Fig. 14), the alternative *"Restaurants, pubs, etc.*" scored highest (59% in 2019), followed by *"Culture and entertainment*" (47% in 2019). The qualities most highly appreciated were the same each year and mostly appeared in the same order. Interestingly, the alternatives *"Access to the fjord," "Squares, places, and parks,"* and *"Pedestrian streets, car-free areas"* gained considerably more votes in 2018 and 2019 than they did in 2017. These increases may indicate that city center users appreciate street-space reallocation and other interventions. Whereas 23 percent valued *"Pedestrian streets, car-free areas"* in 2017, this rate increased to 29 percent in 2019.

An open-ended question was included in the survey to ask what the users did not appreciate in the city center. Categorizing the answers for each year, we found that the most frequently reported disfavored element was *"Street vendors, beggars, and drug addicts,"* with response rates varied from 21 percent in 2019 to 29 percent in 2017. Concurrently, respondents expressed concern about the well-being of beggars and those addicted to drugs and how society treats these people. The alternative *"Too much car traffic, parked cars, buses, goods delivery, etc.*" received the second-highest response rate (20% in all years). Opposite to this alternative were responses disliking the car and parking restrictions (11% in 2019, 15% in 2018, 10% in 2017). Other disliked elements included space-consuming construction work and challenges in their interaction with other street users. In 2019, some respondents also mentioned shared electric scooters for public use, which were first distributed in the city center that spring.

4.3. Attitudes, understandings, and expectations

We asked the respondents how they expected the interventions to affect people's use of the city center, aiming at bringing insights into the attitudes, understandings, and expectations of the city center users and whether this differed from the mainly negative voices

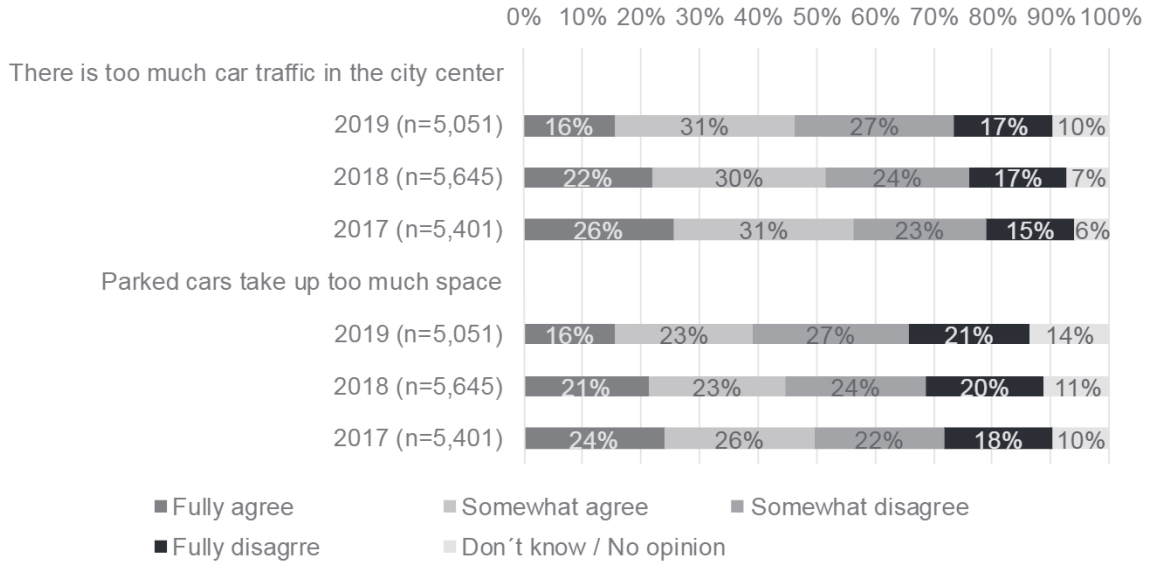

Fig. 12. Responses to the statements, "There is too much car traffic in the city center" and "Parked cars take up too much space." The respondents were asked how much they agreed or disagreed with the statements.

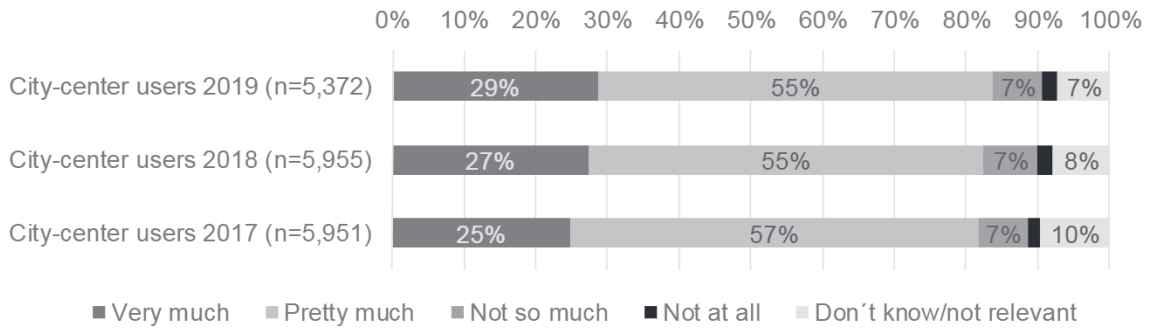

Fig. 13. Responses to the question, "How much do you enjoy staying in the city center this time of year?"

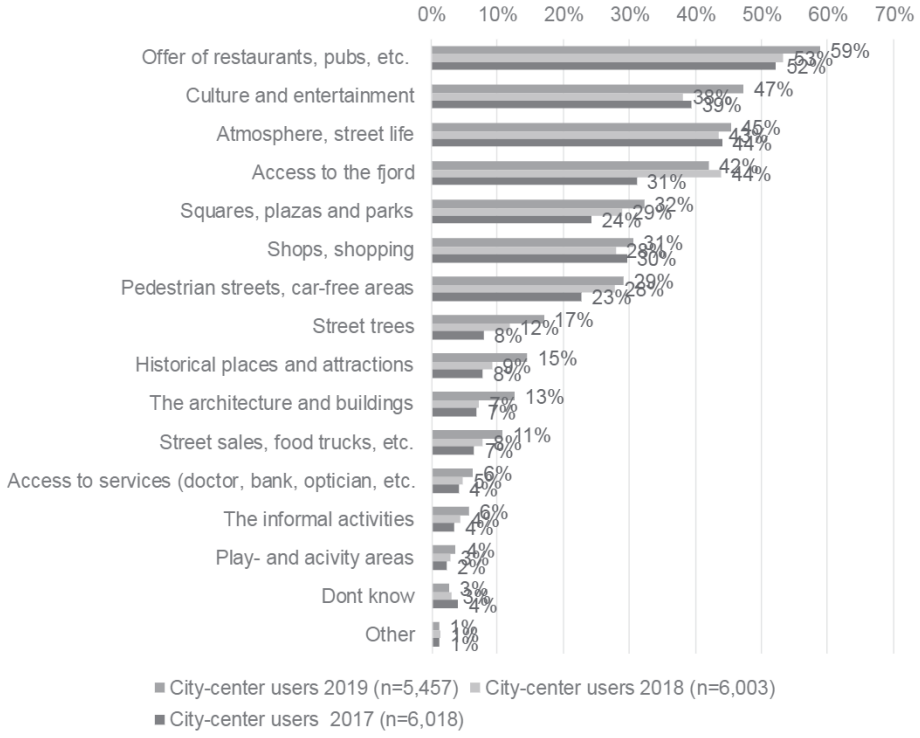

Fig. 14. Responses to the question, "What do you appreciate the most in Oslo's city center? Select up to four options."

in the public debate. We found that many city center users expected the interventions to cause more people to use the city center (Fig. 15). However, this anticipation changed over the three years of surveys—the proportions believing that "more people will use the center of Oslo" were gradually reduced, going from 43 percent in 2017 to 40 percent in 2018 and 37 percent in 2019. Nevertheless, each year, a higher proportion believed more people would use the center (37% in 2019) than believed fewer people would do so (18% in 2019).

Despite these expectations, most city center users did not expect to change how they used the city center (Fig. 16). In both 2017 and 2018, the shares answering that they would use the city center more often were higher than the shares thinking they would visit more seldom. In 2019, these shares were equal.

In 2019, we asked respondents, "*How have the city center interventions implemented so far affected your use of the city center?*" The results are given in Appendix C. Most respondents, at 66 percent, said their use had not been affected. Interestingly, more than twice as many reported they used the city center less frequently (18%) than more frequently (7%). These responses contrast with the responses to the question about how often they visit the city center (Fig. 9), where no significant changes were found.

We analyzed whether there were any differences in the characteristics of respondents stating that they used the city center less compared with those using it more often, but we found few apparent differences. (See Appendix C). However, the shares answering "more often" were higher among those aged 25–34 years (11%) than among other age groups (5%–7%). The shares using the city center less frequently declined with increasing levels of education. Respondents with children younger than 18 years living at home

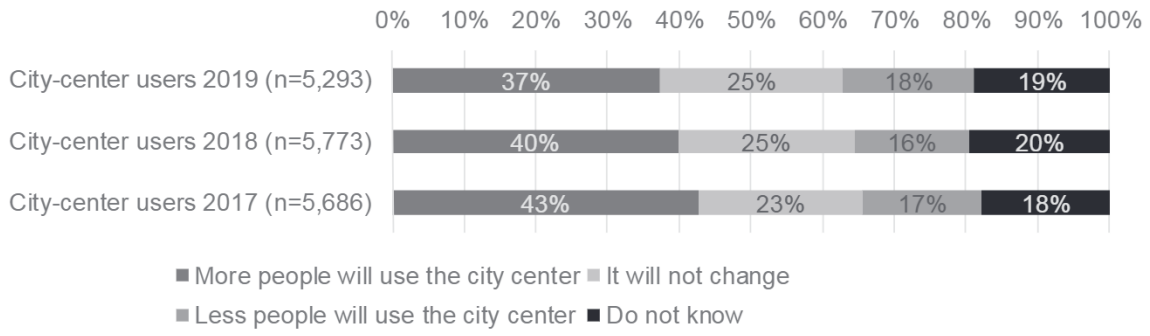

Fig. 15. Responses to the question, "How do you think the city center interventions will affect inhabitants' use of Oslo's city center? Select the statement you agree with the most."

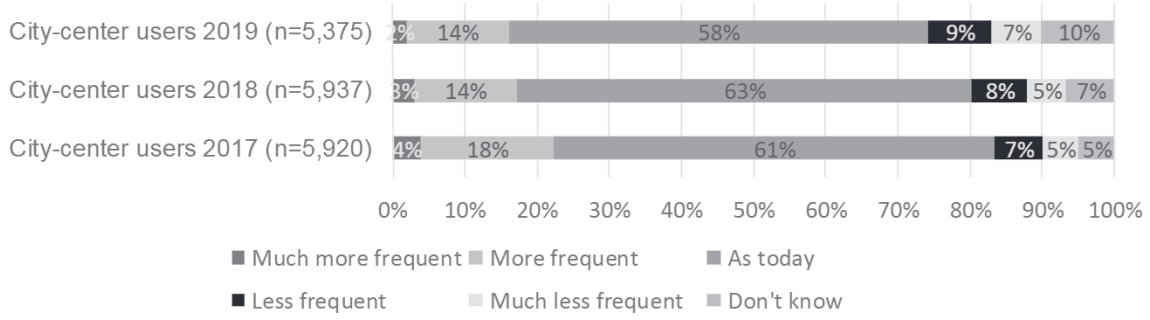

Fig. 16. Responses to the question, "How do you think the city center interventions will affect your use of Oslo's city center" Select the statement you agree with the most."

were more likely to say that they visited less frequently (20%) compared with other groups (16%). Those who owned a car tend to answer that they visited less often (21%) as compared with those who did not own a car (7%). In open answers and comments to the surveys, several respondents pointed to life-situation changes (e.g., having children) to explain why they used the city center less often, and they clarified that it was not related to the street-space reallocations.

5. Discussion

Having investigated how commuters and city center users adapted to the rapid and radical street-space reallocation from parking and driving to other modes and uses in the Oslo city center and what effects and consequences they experienced, we can say that the overall answer is "not much." Understandings of expected adaptations, effects, and consequences were derived from previous research, as described in Section 1. Annual surveys conducted before, during, and after the interventions' implementation, disseminated to employees of businesses located in Oslo, were the primary basis of the research. The respondents answered a battery of questions concerning their commutes and their use of and perception of the city center. The results were analyzed with particular attention to whether the interventions that took place from 2017 to 2019 affected these parameters. Table 2 presents the key findings.

Table 2
Summary of adaptations, effects, and consequences of street-space reallocation for the two user groups.

	Adaptations	Effects	Consequences
Commuters	No adaptations in terms of shifting transport modes; most travel by sustainable modes	No changes in travel time in total or per transport mode Increased access to free or charged parking offered by the employer	No significant changes in commute satisfaction; commute satisfaction remained high
City center users	No adaptations in terms of shifting transport modes; most travel by sustainable modes No adaptations in terms of the frequency of city center visits; most already visit the city center often	Increased time used to find parking No changes in reasons for visiting the city center Increased preference for pedestrian streets and car-free areas Somewhat higher average consumption	Slight improvement in how city center users enjoy the city center Easy and slightly improved access to the city center Improved experiences of walking Slightly improved conditions for biking, but facilitation still needed More difficult driving

The city center interventions were understood and investigated as changes in the transport system that could affect travel behavior and travel experiences, including how respondents use and perceive the city center. Previous studies (e.g., Gehl Architects, 2014; Gehl and Gemzøe, 1996) mostly study users' experiences of city centers and changes. The reallocation of street space in the city center of Oslo did not cause significant adaptations among commuters or city center users; the effects and consequences were weak, and they were in line with what could be expected based on previous studies' findings (see Section 1). For instance, in accordance with findings from other studies (Bertolini, 2020; Carmona et al., 2018), the interventions seem to have improved walking and biking experiences in the city center. Even those supposed to be most negatively affected—car drivers—seemed less affected than many anticipated. The lack of adaptations in terms of shifting transport modes contrasts with the findings from previous research (see, among others, Bertolini, 2020; Cairns et al., 2002; Forsyth and Krizek, 2010; Noland and Lem, 2002; Pucher et al., 2010; Pucher and Buehler, 2010). Our findings also differ from the findings in the Brussels study described above (Keserü et al., 2018), reporting adaptations in shifting transport modes and less frequent visits. The limited scope—both because of the lack of a baseline study and fewer questions—makes Keserü et al.'s (2018) results more uncertain than those in this longitudinal study with the large battery of investigations presented in this paper.

There could be several explanations for the lack of significant adverse impacts in Oslo. The proportions of city center users and commuters traveling by car were already low before implementing interventions, meaning that relatively few people were affected by the car restrictions. Furthermore, although on-street parking was removed, most of the city center's parking capacity remained unchanged through continued access to parking garages. Apparently, the parking-garage capacity was high enough to accommodate the demand. Most of the traffic passing the city center had been moved from surface streets to underground motorway tunnels many years before, meaning that banning through-traffic there did not have a large effect on traffic volumes. The extensive construction work taking place in the investigated period—because of street-space reallocations, upgrading tram lines, and new and refurbished buildings—could partly explain the lack of substantial positive impacts. These construction works negatively affected the accessibility in and to the city center and the comfort of using the city center, as evident in the responses to the open questions. Given this result, it might be more surprising that city center users reported improved experiences when moving around the city center as pedestrians. The findings also showed weak but positive trends of more people reporting that they enjoyed being there and experienced improved accessibility. Negative issues related to car traffic and parking were still among the most frequently mentioned characteristics when respondents listed what they did not appreciate in the city center.

A weakness of the study presented here, focusing on the effects of changes in the transport system on travel behavior and experiences, is the lack of analysis of how traffic in the city center changed. However, Oslo municipality's consultants measured this and found that car traffic volumes were reduced by 11 percent from 2016 to 2018 and by 19 percent from 2018 to 2019 (Stridh and Norgård, 2020). Other consultants counted people walking or staying in several city center streets and plazas and found both numbers to be increasing from 2017 to 2019 (Lindøen-Høifors et al., 2019). This growth could also indicate an increased number of city center visitors during these years. However, these registrations represent the situation of a few days and are not suited for firm comparisons and conclusions. Another issue that was not well covered in the present study is how the interventions affected city center retail and service businesses. The survey results showed a somewhat increasing frequency of visits and amount of money spent on each visit. These changes could indicate an increased turnover in the whole city center. However, we did not inquire directly into the experiences of and effects on retail and service businesses. Consultants investigating this issue for the municipality found a weak increase in turnover in the city center from 2017 to 2018 and higher turnover than in reference areas (Mehammer et al., 2019). They also found that the city center had become a more popular place to establish businesses. These findings are in accordance with data from Statistics Norway, which showed slight increases in the numbers of residents, employees, and businesses in the city center from 2017 to 2019 (Municipaity of Oslo, 2021). Within the scope of our study, we do not address changes in city center rental prices nor gentrification. Addressing such consequences would require a different research design than applied and is hence not discussed. Such investigations would be a valuable contribution in future research on street-space reallocations.

This paper does not discuss the effects of freight delivery transport. Other studies included in the same project to which this article belongs revealed that truck drivers report worsened conditions for delivering goods in the city center because of the interventions (Caspersen and Ørving, 2020). As mentioned in earlier sections, city center residents' experiences of the interventions have not been addressed. The number of residents in the investigated area is very low (less than 1,400 inhabitants in 2019). The removed parking spaces were typically visitors' parking (paid and with time restrictions); therefore, residents' car access was maintained, and access to parking garages was unchanged. Consequently, we consider that residents would be less affected by the changes than the investigated user groups.

The survey results showed a relatively high yet declining optimism concerning whether the city center changes would result in more people using it. This reduction could be explained by high expectations and frustration when the promised improvements took so long. (The interventions were announced in 2015, then realized in stepwise fashion from 2017). It could also have resulted from some people expecting more extensive changes than were ultimately implemented. A survey among Oslo inhabitants, conducted by the municipality, also indicates the support of the street-space reallocation scheme, with a higher share in favor of than opposing car-free streets both in the city center and in general (Municipality of Oslo Klimaetaten, 2019). The Oslo findings align with those found in other European cities (Gundlach et al., 2018; Keserü et al., 2018, Sustrans, 2020) and underline the importance of listening to a broader choir of voices than those loudly opposing the plans in the press and social media.

There are few similar studies of the adaptations, effects, and consequences of the type of intervention realized in Oslo. This limits the possibilities of generalization and comparisons with previous research. The transferability of the findings to other cities is highly context dependent. Cities and city centers with similar characteristics to that of Oslo and Oslo city center may experience similar effects and consequences. Central characteristics include a relatively monocentric quality, a concentration of workplaces in the city center, a

high proportion (38%) of residents within Oslo municipality living in the inner city within walking and biking distance to the center, low traffic levels in the city center streets, high overall parking capacity in parking garages, and high shares using public transport. In cities that are more car dependent than Oslo, city center users and employees are likely to be more affected by similar changes, with more people having to adapt in various ways. For cities implementing street-space reallocations in downtown areas with a higher number of residents, and where interventions also affect residents' parking, considerations of potential effects and consequences for these user groups are important.

6. Concluding remarks

Based on the reported findings, one could conclude that the reallocation of street space from cars to other modes and uses in the Oslo city center, conducted over a period of three years, does not seem to have contributed negatively to the center's vibrancy and attractiveness. Instead, the results suggest that the interventions have contributed positively to factors relevant for attracting visitors to the city center and businesses where the employees are essential users of the center and its activities. The results show improved travel experiences for those walking and biking in the city center and worsening experiences for those driving their private car there, which could result in shifts toward more sustainable travel behavior in the long run. Most current city center users have positive or neutral expectations for how the interventions will affect people's use of the area. As discussed above, construction work was still ongoing at the time of the latest survey in our study. More interventions are also planned. Hence, we expect that repeating the same survey when the intensive construction period finishes and more changes are complete would show stronger and more positive results.

The study and its results make significant contributions to the existing literature concerning adaptations to and effects and consequences of reallocating street space from cars to other modes and uses in city centers and combining car restrictions with improvements for other modes in general. By understanding the city center interventions as transport-system changes and focusing on the impacts on travel behavior and travel experiences among commuters and city center users, the study has contributed novel knowledge concerning the fundamental issues at stake when discussing the distribution of city center street space. This study is also one of few that we know of investigating how city-wide interventions affecting accessibility by different modes influence the whole city center. Further, the rapid execution of changes make the Oslo city center an excellent case to study, with the short timespan reducing the influence of other city changes (although this is also an issue in this study). Therefore, the study allows more precise understandings of the results to be linked directly to the changes. The case study also benefited from being part of a larger project, conducting city-wide surveys since 2015, which established a solid baseline for the study. This kind of starting point is missing in most previous studies. As all cities are different and context matters, the results could have been different if another city had carried out similar interventions. For instance, a city with higher car dependency or higher traffic volumes through the city center would probably experience other impacts; as a concrete example, the results from the Brussels study were different from the Oslo findings.

The study and findings may be useful and relevant to other cities considering similar interventions. City centers are often the most important and complex areas in cities. Suggestions of radical changes are often met with worries and opposition. A lack of reliable empirical studies of real-life cases causes uncertainties that may increase the resistance and the risk of unintended and unwanted impacts. This empirical study from Oslo, documenting how groups significant for the vitality and vibrancy of the city center experienced and adapted to the rapidly implemented and radical interventions, might make an essential contribution to the relatively scarce knowledge base concerning this issue. The results illustrate that reallocating street space from cars to other modes and uses may be a feasible strategy for making city centers more vibrant and attractive and might not necessarily reduce actual and experienced accessibility. These findings are in line with what has been found in previous studies (see Section 1). We believe the findings may expand planners', policymakers', and decision makers' understandings of feasible and relevant interventions, helping them accelerate the development toward more sustainable and people-friendly city centers and cities. Although prioritizing walking and biking over cars is largely agreed upon as an important measure to meet central societal goals, reallocating street space is still considered radical by many. The dissent is evident in resistance among political opposition groups, city users, businesses, and others, and it is often broadly discussed in mainstream and social media. This was, and still is, the case in Oslo, as well as in other cities. Therefore, continued research on the topic of temporary and permanent reallocation of street space is needed.

CRediT authorship contribution statement

Oddrun Helen Hagen: Conceptualization, Methodology, Investigation, Formal analysis, Writing - original draft. **Aud Tennøy:** Conceptualization, Methodology, Investigation, Formal analysis, Writing - original draft, Supervision, Project administration, Funding acquisition.

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Appendix A. Selected characteristics of the yearly survey samples

	City center users			Commuters				
Year Number of respondents	2017 n = 6,018	2018 n = 6,003	2019 n = 5,457	2015 n = 548	2016 n = 1,611	2017 n = 1,031	2018 n = 1,181	2019 n = 882
Gender								
Male	55%	55%	52%	53%	55%	58%	61%	56%
Female	43%	42%	42%	46%	44%	41%	36%	39%
Other/will not say	2%	3%	6%	1%	1%	2%	4%	5%
Age								
18–24 years	1%	1%	1%	1%	1%	0%	1%	1%
25–34 years	19%	17%	18%	14%	17%	16%	15%	15%
35–44 years	24%	22%	23%	26%	23%	23%	21%	22%
45–54 years	25%	26%	26%	32%	29%	27%	27%	29%
55–66 years	21%	21%	21%	24%	23%	22%	23%	22%
67–74 years	2%	2%	1%	3%	1%	2%	2%	2%
Not given	9%	12%	9%	0%	5%	11%	11%	8%
Number of children younger than 18 years living at home								
No children	59%	53%	56%	54%	57%	60%	53%	54%
One child	16%	15%	15%	14%	15%	15%	16%	15%
Two or more children	25%	25%	25%	31%	28%	25%	24%	25%
Not given	0%	7%	5%	0%	0%	0%	7%	5%
Marital status								
Married/cohabitant	73%	71%	71%	78%	76%	72%	71%	71%
Singel	23%	22%	22%	19%	21%	24%	22%	24%
Other/not given	4%	7%	6%	3%	3%	3%	7%	6%
Education level								
Primary school	1%	1%	1%	0%	1%	1%	1%	0%
High school	10%	9%	8%	5%	9%	10%	8%	7%
College/university, short	27%	26%	25%	28%	23%	26%	22%	22%
College/university, long	60%	61%	62%	65%	65%	61%	66%	66%
Other/Not given	2%	3%	5%	2%	2%	3%	3%	4%
Income (NKR)								
Less than 299,000	1%	2%	1%	1%	1%	0%	2%	1%
300,000–399,000	3%	2%	2%	1%	3%	2%	2%	1%
400,000–499,000	17%	14%	11%	12%	18%	17%	15%	8%
500,000–599,000	24%	24%	23%	24%	20%	25%	24%	22%
600,000–690,000	18%	20%	20%	25%	19%	15%	20%	22%
700,000–799,000	10%	10%	12%	11%	11%	9%	9%	12%
800,000–899,000	7%	7%	8%	7%	7%	7%	8%	9%
900,000–999,000	4%	5%	6%	5%	5%	5%	5%	7%
More than 1,000,000	7%	9%	10%	7%	9%	10%	9%	10%
Do not know/Not given	8%	8%	9%	4%	7%	10%	7%	2%
Driver License								
Yes	92%	92%	92%	–	93%	94%	92%	93%
No	8%	8%	8%	–	7%	6%	8%	7%
Car ownership								
No	18%	19%	15%	–	17%	18%	21%	16%
Yes, car sharing or similar	4%	3%	4%	–	3%	4%	4%	5%
Yes	78%	78%	81%	–	80%	78%	75%	80%
Number of cars in household (only asked those answering yes on car ownership)								
One car	51%	50%	49%	–	53%	50%	49%	51%
Two or more cars	27%	28%	27%	–	26%	29%	26%	25%
Not given	22%	22%	24%	–	20%	22%	25%	24%

Appendix B. Survey questions and data summary: Commuters' responses

Commuters' answers to the question "By which transport mode did you travel the longest the last time you traveled to work and met where you usually meet?"

	2015 (n = 548)	2016 (n = 1,611)	2017 (n = 1,031)	2018 (n = 1,181)	2019 (n = 882)
Walking	6%	6%	7%	9%	10%
Bicycling	15%	18%	13%	18%	14%
Public transport	71%	68%	73%	65%	66%
Car (driver)	5%	6%	4%	5%	7%
Car (passenger)	1%	1%	1%	1%	1%
Other	1%	1%	1%	1%	1%
Total	100%	100%	100%	100%	100%

Commuters' answers to the question "*Do you commute differently now as compared to this time last year?*". Respondents could select more than one answer. The question was not asked in 2015.

	2016 (n = 1,611)	2017 (n = 1,031)	2018 (n = 1,181)	2019 (n = 882)
No	78%	74%	76%	79%
Yes, more often car driver	2%	2%	2%	2%
Yes, less often car driver	1%	2%	2%	2%
Yes, more often car passenger	1%	1%	1%	1%
Yes, less often car passenger	0%	0%	0%	0%
Yes, I travel more often by public transport	4%	7%	5%	5%
Yes, I travel more seldom by public transport	2%	2%	2%	2%
Yes, I bike more often	4%	3%	6%	4%
Yes, I bike more seldom	2%	3%	2%	2%
Yes, I walk more often	2%	3%	3%	3%
Yes, I walk more seldom	1%	1%	1%	1%
Yes, other changes in my commute	4%	6%	4%	4%
Total	101%	104%	104%	105%

Calculated commuting time for 2017, 2018 and 2018, in minutes, both in total and by various transport modes. Average travel times *in minutes* based on commuting starting time and arrival time at workplace cross tabulated with answers to the question "*By which transport mode did you travel the longest the last time you travelled to work and met where you usually meet?*"

	Walking2017 (n = 74)	2018 (n = 103)	2019 (n = 81)
	25 min	29 min	27 min
Bicycling	2017 (n = 130)	2018 (n = 204)	2019 (n = 124)
	25 min	28 min	28 min
Public transport	2017 (n = 752)	2018 (n = 719)	2019 (n = 572)
	43 min	47 min	45 min
Car (driver)	2017 (n = 43)	2018 (n = 62)	2019 (n = 65)
	34 min	33 min	38 min
Car (passenger)	2017 (n = 14)	2018 (n = 13)	2019 (n = 10)
	33 min	34 min	46 min
Motorcycle/scooter	2017 (n = 9)	2018 (n = 7)	2019 (n = 4)
	18 min	21 min	21 min
Other	2017 (n = 6)	2018 (n = 5)	2019 (n = 3)
	51 min	56 min	41 min
Regardless of mode	2017 (n = 1,028)	2018 (n = 1,113)	2019 (n = 859)
	39 min	41 min	41 min

Commuters' responses to the question "If you are going to drive to work, do you have the opportunity to park at or near your workplace?". Respondents could select more than one answer. The question was not asked in 2015.

	2016 (n = 1,611)	2017 (n = 1,031)	2018 (n = 1,181)	2019 (n = 882)
No	25%	29%	25%	21%
Yes, for free or charged on-street parking	14%	13%	6%	4%
Yes, free or charged parking offered by my employer	33%	23%	32%	42%
Yes, other free or charged parking (parking garage etc)	26%	31%	25%	23%
Don't know	9%	10%	13%	15%
Other	6%	4%	6%	7%
Total	113%	110%	107%	112%

Commuters' responses to the questions "*How satisfied are you with your commute based on how you normally travel?*"

	2015 (n = 548)	2016 (n = 1,611)	2017 (n = 1,031)	2018 (n = 1,181)	2019 (n = 882)
Very satisfied	28%	35%	34%	32%	35%
Satisfied	47%	44%	45%	43%	44%
Neither nor	14%	11%	11%	13%	10%
Dissatisfied	8%	7%	8%	8%	8%
Very dissatisfied	3%	3%	2%	4%	3%
Total	100%	100%	100%	100%	100%

Commuters' responses to the questions "*How satisfied are you with the commute based on how you normally travel*?" cross tabulated with answers to the question "*By which transport mode did you travel the longest the last time you traveled to work and met where you usually meet?*"

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Commuters' responses to the questions "*How satisfied are you with the commute based on how you normally travel*?" cross tabulated with answers to the question "*By which transport mode did you travel the longest the last time you traveled to work and met where you usually meet*?"

	Walking 2015 (n = 32)	Walking 2016 (n = 103)	Walking 2017 (n = 74)	Walking 2018 (n = 108)	Walking 2019 (n = 84)
	Walking 2015 (n = 32)	Walking 2016 (n = 103)	Walking 2017 (n = 74)	Walking 2018 (n = 108)	Walking 2019 (n = 84)
Very satisfied	75%	66%	72%	63%	68%
Satisfied	19%	22%	24%	23%	23%
Neither nor	3%	3%	0%	5%	0%
Dissatisfied	0%	2%	1%	2%	5%
Very dissatisfied	3%	7%	3%	7%	4%
Total	100%	100%	100%	100%	100%
	Bicycling 2015 (n = 83)	Bicycling 2016 (n = 283)	Bicycling 2017 (n = 130)	Bicycling 2018 (n = 216)	Bicycling 2019 (n = 127)
Very satisfied	24%	44%	35%	34%	42%
Satisfied	53%	42%	48%	46%	46%
Neither nor	10%	7%	12%	10%	5%
Dissatisfied	10%	5%	4%	7%	5%
Very dissatisfied	4%	2%	1%	3%	2%
Total	100%	100%	100%	100%	100%
	Public transport 2015 (n = 388)	Public transport 2016 (n = 1090)	Public transport 2017 (n = 755)	Public transport 2018 (n = 763)	Public transport 2019 (n = 586)
Very satisfied	26%	31%	30%	27%	30%
Satisfied	47%	48%	48%	46%	47%
Neither nor	16%	12%	12%	15%	12%
Dissatisfied	9%	8%	9%	8%	8%
Very dissatisfied	3%	2%	1%	4%	3%
Total	100%	100%	100%	100%	100%
	Car driver 2015 (n = 30)	Car driver 2016 (n = 94)	Car driver 2017 (n = 43)	Car driver 2018 (n = 64)	Car driver 2019 (n = 66)
Very satisfied	27%	36%	35%	39%	29%
Satisfied	46%	30%	30%	38%	47%
Neither nor	17%	21%	21%	9%	12%
Dissatisfied	7%	7%	7%	11%	8%
Very dissatisfied	3%	5%	7%	3%	5%
Total	100%	100%	100%	100%	100%
	Car passenger 2015 (n = 7)	Car passenger 2016 (n = 18)	Car passenger 2017 (n = 14)	Car passenger 2018 (n = 14)	Car passenger 2019 (n = 11)
Very satisfied	43%	28%	36%	36%	36%
Satisfied	43%	39%	50%	29%	37%
Neither nor	14%	16%	7%	21%	9%
Dissatisfied	0%	17%	0%	7%	18%
Very dissatisfied	0%	0%	7%	7%	0%
Total	100%	100%	100%	100%	100%
	Other modes 2015 (n = 8)	Other modes 2016 (n = 23)	Other modes 2017 (n = 15)	Other modes 2018 (n = 11)	Other modes 2019 (n = 8)
Very satisfied	7%	17%	39%	49%	10%
Satisfied	36%	29%	45%	24%	70%
Neither nor	57%	53%	17%	18%	20%
Dissatisfied	0%	0%	0%	5%	0%
Very dissatisfied	0%	2%	0%	5%	0%
Total	100%	100%	100%	100%	100%

Appendix C. Survey questions and data summary: City center users' responses

City-center users' responses to the question, "*How did you travel the last time you used the city center?*"

	2017 (n = 5,389)	2018 (n = 5,611)	2019 (n = 4,881)
Walking	11%	11%	11%

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(*continued*)

City-center users' responses to the question, "*How did you travel the last time you used the city center?*"

	2017 (n = 5,389)	2018 (n = 5,611)	2019 (n = 4,881)
Bicycling	7%	11%	9%
Public transport	68%	66%	69%
Car (driver)	9%	8%	7%
Car (passenger)	3%	2%	2%
Other	2%	1%	1%
Total	100%	100%	100%

City-center users' responses to the question, "*How often do you visit the city center, excluding jobs and job meetings, at this time of year?*"

	2017 (n = 5,987)	2018 (n = 5,976)	2019 (n = 5,403)
Several times a week	19%	21%	19%
About once a week	23%	24%	23%
1–3 times a month	25%	25%	27%
About once a month	14%	13%	15%
A few times a year	13%	13%	12%
Never or very seldom	5%	5%	5%
Don't know/not relevant	1%	1%	0%
Total	100%	100%	100%

City-center users' responses to the question, "*How often do you visit the city center, excluding jobs and job meetings, at this time of year?*" cross-tabulated with city-center users' responses to the question, "*How did you travel the last time you used the city center?*"

	Walking		
	2017 (n = 595)	2018 (n = 638)	2019 (n = 543)
Several times a week	39%	43%	46%
About once a week	29%	31%	27%
1–3 times a month	18%	17%	17%
About once a month	7%	5%	7%
A few times a year	7%	4%	3%
Total	100%	100%	100%
	Bicycling		
	2017 (n = 391)	2018 (n = 633)	2019 (n = 435)
Several times a week	31%	36%	35%
About once a week	36%	29%	30%
1–3 times a month	24%	24%	22%
About once a month	8%	7%	9%
A few times a year	2%	3%	3%
Total	100%	100%	100%
	Public transport		
	2017 (n = 3,659)	2018 (n = 3,728)	2019 (n = 3,500)
Several times a week	16%	17%	15%
About once a week	24%	24%	24%
1–3 times a month	29%	28%	31%
About once a month	16%	17%	17%
A few times a year	14%	14%	14%
Total	100%	100%	100%
	Car (driver)		
	2017 (n = 489)	2018 (n = 435)	2019 (n = 386)
Several times a week	11%	15%	13%
About once a week	22%	22%	22%
1–3 times a month	25%	25%	26%
About once a month	21%	15%	18%
A few times a year	21%	23%	21%
Total	100%	100%	100%
	Car (passenger)		
	2017 (n = 178)	2018 (n = 112)	2019(n = 126)
Several times a week	11%	9%	10%
About once a week	13%	22%	21%
1–3 times a month	29%	33%	20%
About once a month	24%	11%	26%
A few times a year	24%	25%	23%
Total	100%	100%	100%

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City-center users' responses to the question, "*Did you park inside Ring road 1 the last time you drove by car to the city center?*". Only asked those driving the last time they visited the city center.

	2017 (n = 473)	2018 (n = 421)	2019 (n = 374)

City-center users' responses to the question, "*Did you park inside Ring road 1 the last time you drove by car to the city center?*". Only asked those driving the last time they visited the city center.

	2017 (n = 473)	2018 (n = 421)	2019 (n = 374)
No, I parked outside Ring 1	14%	12%	14%
Yes, I used on-street parking	39%	30%	29%
Yes, I parked in a parking garage	32%	40%	40%
Yes, I parked in a private parking place (my own, provided by my employer, or other reserved parking)	12%	17%	16%
Do not know/do not remember/other	2%	1%	1%
Total	100%	100%	100%

City-center users' responses to the question, "*How long did it take to park your car? Enter time in minutes (0–30).*" Only asked those driving the last time they visited the city center.

	2017 (n = 405)	2018 (n = 429)	2019 (n = 381)
0–5 min	74%	67%	63%
6–10 min	13%	10%	14%
11–15 min	6%	8%	8%
16–20 min	3%	5%	7%
More than 20 min	3%	9%	8%
Total	100%	100%	100%

City-center users' responses to the question, "*What did you do on your last visit to the city center? Do not include the 17th of May [Norway's national day] if relevant. Specify all relevant activities.*" Sorted by distribution for 2019. Respondents could select more than one answer.

	2017 (n = 6,018)	2018 (n = 6,003)	2019 (n = 5,457)
Restaurant, pub, café	41%	44%	43%
Shopping	35%	37%	35%
Meeting friends	24%	29%	27%
Culture and entertainment	18%	17%	19%
Work or work meetings	20%	22%	18%
Enjoying the urban atmosphere and street life	13%	16%	12%
Other kind of activities	7%	7%	8%
Travelling through	8%	9%	7%
Visiting a doctor, dentist etc.	6%	7%	7%
Other kind of services	5%	6%	6%
Visiting someone living there	5%	5%	5%
Do not remember	3%	4%	2%
Other	1%	1%	1%
Total	185%	205%	192%

Average amount of money spent in Norwegian Kroner (NKR) based on city-center users' responses to the question, "*How much money did you spend the last time you visited the city center?*", cross-tabulated with answers to the question "*How did you travel the last time you used the city center?*" Not index-linked.

	2017 (n = 4,389)	2018 (n = 5,645)	2019 (n = 4,156)
Walking	695 NKR	709 NKR	739 NKR
Biking	506 NKR	594 NKR	611 NKR
Public transport	797 NKR	749 NKR	875 NKR
Car (driver)	1170 NKR	1057 NKR	1263 NKR
Car (passenger)	1009 NKR	847 NKR	1234 NKR
Taxi	1297 NKR	1189 NKR	1795 NKR
Other/Do not know/remember	969 NKR	430 NKR	1040 NKR
Average regardless of mode	812 NKR	755 NKR	883 NKR

City-center users' responses to the question "*How easy do you find it to get to the city center at this time of year?*"

	2019 (n = 4,958)	2018 (n = 5,506)	2017 (n = 5,311)
Very easy	61%	56%	55%
Rather easy	33%	37%	40%
Rather difficult	4%	5%	4%
Very difficult	2%	1%	1%
Do not know	1%	1%	1%
Total	100%	100%	100%

City-center users' responses to statements concerning walking in the center

	Fully agree	Somewhat agree	Somewhat disagree	Fully disagrre	Don't know / No opinion	Total
"I enjoy walking in the city center"						
2019 (n = 5,051)	47%	39%	9%	3%	2%	100%
2018 (n = 5,645)	48%	37%	9%	3%	3%	100%
2017 (n = 5,401)	47%	37%	11%	4%	2%	100%
"There is enough space for pedestrians on sidewalks and in pedestrian streets"						
2019 (n = 5,051)	30%	40%	22%	5%	3%	100%
2018 (n = 5,645)	30%	37%	23%	7%	3%	100%
2017 (n = 5,401)	27%	38%	25%	8%	2%	100%
"The walking areas are well designed and good for walking"						
2019 (n = 5,051)	20%	44%	25%	5%	6%	100%
2018 (n = 5,645)	18%	41%	27%	7%	7%	100%
2017 (n = 5,401)	17%	41%	29%	7%	6%	100%
"The number of benches is sufficient"						
2019 (n = 5,051)	11%	25%	28%	8%	27%	100%
2018 (n = 5,645)	10%	24%	30%	13%	23%	100%
2017 (n = 5,401)	9%	24%	31%	13%	24%	100%
"Winter maintenance (snow and ice clearing) in the city center is good"						
2019 (n = 5,051)	10%	28%	28%	16%	17%	100%
2018 (n = 5,645)	6%	22%	30%	28%	15%	100%
2017 (n = 5,401)	12%	34%	23%	10%	20%	100%
"It sometimes feels unsafe to walk in the city center in evenings and nights"						
2019 (n = 5,051)	18%	37%	22%	11%	11%	100%
2018 (n = 5,645)	15%	39%	22%	13%	11%	100%
2017 (n = 5,401)	20%	40%	21%	11%	9%	100%
"I feel that pedestrians have the highest priority in the city-center streets"						
2019 (n = 5,051)	14%	33%	30%	10%	14%	100%
2018 (n = 5,645)	11%	31%	32%	14%	12%	100%
2017 (n = 5,401)	10%	28%	34%	17%	11%	100%
"There is too much car traffic in the city center"						
2019 (n = 5,051)	16%	31%	27%	17%	10%	100%
2018 (n = 5,645)	22%	30%	24%	17%	7%	100%
2017 (n = 5,401)	26%	31%	23%	15%	6%	100%
"Parked cars take up too much space"						
2019 (n = 5,051)	16%	23%	27%	21%	14%	100%
2018 (n = 5,645)	21%	23%	24%	20%	11%	100%
2017 (n = 5,401)	24%	26%	22%	18%	10%	100%
"It is safe and easy to cross streets with car traffic"						
2019 (n = 5,051)	23%	46%	23%	5%	3%	100%
2018 (n = 5,645)	22%	44%	26%	6%	2%	100%
2017 (n = 5,401)	22%	44%	24%	7%	2%	100%
"Public transport takes up too much space"						
2019 (n = 5,051)	4%	13%	32%	43%	8%	100%
2018 (n = 5,645)	4%	16%	31%	43%	7%	100%
2017 (n = 5,401)	4%	15%	31%	43%	6%	100%
"There is too many cycling on sidewalks and in pedestrian streets"						
2019 (n = 5,051)	21%	33%	24%	12%	10%	100%
2018 (n = 5,645)	20%	34%	23%	14%	10%	100%
2017 (n = 5,401)	19%	33%	24%	14%	10%	100%
"Deliveries of goods in the city center is not a problem for me as a pedestrian"						
2019 (n = 5,051)	39%	32%	13%	5%	12%	100%
2018 (n = 5,645)	–	–	–	–	–	–
2017 (n = 5,401)	–	–	–	–	–	–

City-center users' responses to statements concerning biking in the center

	Fully agree	Somewhat agree	Somewhat disagree	Fully disagrre	Don't know / No opinion	Total
"I experience few conflicts with other road users when cycling in the center of Oslo"						
2019 (n = 2,940)	9%	25%	25%	14%	27%	100%
2018 (n = 3,404)	9%	26%	25%	14%	26%	100%
2017 (n = 3,152)	10%	24%	23%	16%	27%	100%
"Freight deliveries in the city center is not problematic for me as a cyclist"						
2019 (n = 2,940)	15%	24%	18%	9%	34%	100%
2018 (n = 3,404)	–	–	–	–	–	–
2017 (n = 3,152)	–	–	–	–	–	–
"There are adequate bicycle lanes in the center"						
2019 (n = 2,940)	4%	15%	29%	32%	19%	100%
2018 (n = 3,404)	4%	12%	30%	37%	17%	100%
2017 (n = 3,152)	4%	10%	26%	45%	15%	100%
"There are good and continuous cycling routes through the city center"						

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City-center users' responses to statements concerning biking in the center

	Fully agree	Somewhat agree	Somewhat disagree	Fully disagrre	Don't know / No opinion	Total
2019 (n = 2,940)	3%	12%	28%	35%	22%	100%
2018 (n = 3,404)	3%	11%	27%	39%	20%	100%
2017 (n = 3,152)	3%	8%	25%	46%	19%	100%
"It is easy to find vacant bike parking space"						
2019 (n = 2,940)	7%	22%	21%	12%	38%	100%
2018 (n = 3,404)	7%	21%	23%	14%	35%	100%
2017 (n = 3,152)	7%	20%	23%	17%	33%	100%
"I am not afraid that my bike will be stolen when parked in the city center"						
2019 (n = 2,940)	9%	11%	20%	39%	21%	100%
2018 (n = 3,404)	8%	12%	20%	42%	19%	100%
2017 (n = 3,152)	8%	12%	19%	43%	18%	100%
"It feels safe to bike in the city center"						
2019 (n = 2,940)	5%	20%	33%	24%	17%	100%
2018 (n = 3,404)	6%	23%	35%	21%	16%	100%
2017 (n = 3,152)	5%	21%	34%	26%	15%	100%
"I feel that cyclists have high priority in the city center streets"						
2019 (n = 2,940)	6%	18%	31%	23%	22%	100%
2018 (n = 3,404)	5%	16%	33%	27%	18%	100%
2017 (n = 3,152)	–	–	–	–	–	–

City-center users' responses to statements concerning driving in the center. Only asked in 2018 and 2019.

	Fully agree	Somewhat agree	Somewhat disagree	Fully disagrre	Don't know / No opinion	Total
"It is easy to drive a car in the city center"						
2019 (n = 5,151)	4%	18%	31%	37%	9%	100%
2018 (n = 5,645)	7%	25%	33%	29%	6%	100%
"There is not too much driving prohibition and one-way driving"						
2019 (n = 5,151)	9%	18%	25%	33%	16%	100%
2018 (n = 5,645)	9%	22%	28%	28%	13%	100%
"Wayfinding is easy"						
2019 (n = 5,151)	5%	21%	34%	31%	9%	100%
2018 (n = 5,645)	7%	25%	37%	24%	7%	100%
"It is easy to find parking in the city center"						
2019 (n = 5,151)	3%	11%	24%	48%	14%	100%
2018 (n = 5,645)	4%	14%	26%	46%	11%	100%
"I am not delayed or hindered by other road users"						
2019 (n = 5,151)	3%	18%	36%	24%	19%	100%
2018 (n = 5,645)	4%	19%	40%	22%	14%	100%
"Deliveries of goods in the city center is not a problem for me as a car driver"						
2019 (n = 5,151)	19%	29%	14%	7%	31%	100%
2018 (n = 5,645)						
"I feel that cars have high priority in the city-center streets"						
2019 (n = 5,151)	3%	12%	26%	41%	18%	100%
2018 (n = 5,645)	5%	18%	30%	34%	14%	100%

City-center users' responses to the question "*How much do you enjoy staying in the city center this time of year?*"

	2017 (n = 5,951)	2018 (n = 5,955)	2019 (n = 5,372)
Very much	25%	27%	29%
Pretty much	57%	55%	55%
Not so much	7%	7%	7%
Not at all	2%	2%	2%
Don't know/not relevant	10%	8%	7%
Total	100%	100%	100%

City-center users' responses to the question "*What do you appreciate the most in Oslo's city center? Select up to four options.*"

	2017 (n = 6,018)	2018 (n = 6,003)	2019 (n = 5,457)
Offer of restaurants, pubs, etc.	52%	53%	59%
Culture and entertainment	39%	38%	47%
Atmosphere, street life	44%	43%	45%
Access to the fjord	31%	44%	42%
Squares, plazas and parks	24%	29%	32%
Shops, shopping	30%	28%	31%
Pedestrian streets, car-free areas	23%	28%	29%
Street trees	8%	12%	17%
Historical places and attractions	8%	9%	15%
The architecture and buildings	7%	7%	13%
Street sales, food trucks, etc.	7%	8%	11%
Access to services (doctor, bank, optician, etc.)	4%	5%	6%

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City-center users' responses to the question "*What do you appreciate the most in Oslo's city center? Select up to four options.*"

	2017 (n = 6,018)	2018 (n = 6,003)	2019 (n = 5,457)
The informal activities	4%	4%	6%
Play- and activity areas	2%	3%	4%
Do not know	4%	3%	3%
Other	1%	1%	1%
No answer	0%	0%	1%
Total	288%	316%	361%

City-center users' responses to the question "*How do you think the city center interventions will affect inhabitants' use of Oslo's city center? Select the statement you agree with the most.*"

	2017 (n = 5,686)	2018 (n = 5,773)	2019 (n = 5,293)
More people will use the city center	43%	40%	37%
It will not change	23%	25%	25%
Less people will use the city center	17%	16%	18%
Do not know	18%	20%	19%
Total	100%	100%	100%

City-center users' responses to the question "*How do you think the city center interventions will affect your use of Oslo's city center" Select the statement you agree with the most.*"

	2017 (n = 5,920)	2018 (n = 5,937)	2019 (n = 5,375)
Much more frequent	4%	3%	2%
More frequent	18%	14%	14%
As today	61%	63%	58%
Less frequent	7%	8%	9%
Much less frequent	5%	5%	7%
Don't know	5%	7%	10%
Total	100%	100%	100%

City-center users' responses to the question "*How have the city center interventions implemented so far affected your use of the city center?*". The question was not asked in 2017 or 2018.

	2017	2018	2019 (n = 5,368)
I use the city center more frequently than before	–	–	7%
The changes have not affected my use of the city center	–	–	66%
I use the city center less frequently than before	–	–	18%
Don't know/ not relevant	–	–	9%
Total			100%

Characteristics of respondents answering "*I use the city center more frequently than before*," "*I use the city center less frequently than before*" or other responses to the question "*How has the so-far implemented city-center interventions affected your use of the city center?*". The question was not asked in 2017 or 2018.

	'I use the city center more frequently than before'	'I use the city center less frequently than before'	Other responses
Total shares	7%	18%	75%
Gender (n = 5,192)			
Male	9%	20%	71%
Female	6%	16%	78%
Age (n = 4,866) [1]			
18–24 years	6%	15%	80%
25–34 years	11%	14%	75%
35–44 years	7%	16%	77%
45–54 years	6%	20%	74%
55–66 years	7%	16%	77%
67–75 years	5%	13%	82%
Children (n = 5,102)			
No children	8%	16%	77%
1 child	6%	23%	71%
2 children	6%	16%	77%
3 or more children	6%	25%	69%
Average with children	6%	20%	74%
Marital status (n = 5,220)			
Married/partner	7%	19%	74%
Single	8%	15%	77%
Other	3%	20%	77%
Education level (n = 5,188) [2]			
Primary school	8%	28%	64%
High school	4%	27%	69%
College/university, short	5%	23%	72%
College/university, long	8%	14%	78%

(*continued on next page*)

(*continued*)

Characteristics of respondents answering "*I use the city center more frequently than before*," "*I use the city center less frequently than before*" or other responses to the question "*How has the so-far implemented city-center interventions affected your use of the city center?*". The question was not asked in 2017 or 2018.

	'I use the city center more frequently than before'	'I use the city center less frequently than before'	Other responses
Other/Not given			
Personal Income (NKR) (n = 5,292) [3]			
Less than 299,000	6%	14%	79%
300,000–399,000	7%	22%	71%
400,000–499,000	8%	17%	75%
500,000–599,000	7%	17%	76%
600,000–699,000	7%	16%	77%
700,000–799,000	8%	16%	76%
800,000–899,000	7%	21%	73%
900,000–999,000	9%	16%	75%
More than 1,000,000	8%	22%	70%
Do not know/Not given	2%	23%	74%
Car ownership? (n = 5,368)			
No	11%	7%	82%
Yes, car sharing or similar	11%	3%	85%
Yes	6%	21%	73%

[1] There are few respondents among the youngest and oldest age groups.
[2] There are few respondents who stated primary school as the highest level of education.
[3] There are few respondents who have stated income in the highest and lowest income groups.

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