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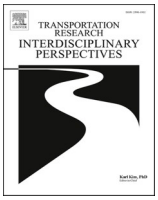

Residents' acceptance towards car-free street experiments: Focus on perceived quality of life and neighborhood attachment

Elizabeth Marcheschi [a,b,*], Nina Vogel [c], Anders Larsson [c], Sonja Perander [c], Till Koglin [d]

[a] Swedish University of Agricultural Sciences, Department of People and Society, Sweden
[b] Architecture and Civil Engineering, Chalmers University, (ACE), Sweden
[c] Landscape Architecture, Planning and Management, Swedish University of Agricultural Sciences, Sweden
[d] Department of Technology and Society, Lund University, Sweden

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ABSTRACT

While the twentieth century was dominated by private car usage, shifts towards more sustainable urban mobility, to mitigate environmental damage and increase health benefits, are now taking place. In Scandinavia, several car-free street experiments take form, that span from permanent car-free inner-city plans (i.e. Oslo) to temporary interventions (i.e. pop-up plaza and parklets) to shift the use of urban settings and infrastructures from motorised traffic towards spaces for people and social interactions. Specifically, in Sweden, transitory car-free street experiments (i.e. summer streets) are developed with the purpose of creating novel mobility patterns and uses of public spaces that enhance social inclusion and quality of life. Despite Swedish municipalities' monitoring of these interventions, very little is known about which physical parameters (i.e. environmental qualities) and psychosocial processes (i.e. emotional relation with places) affect people's acceptance and place usability during car-free initiatives. Following the guidelines proposed by the European Commission, this paper focuses on residents' perception of car-free street experiments. The aim is to identify how acceptance and usability of car-free street experiments might vary depending on the perceived qualities of the physical urban settings and on interceding psychosocial processes such as, neighborhood attachment and perceived quality of life. An interdisciplinary methodology of investigation merging knowledge from the field of environmental psychology, landscape architecture, urban transport and planning was applied on four case studies in Sweden. Results suggest that psychosocial processes of place attachment and quality of life are relevant in order to understand the level of acceptance towards car-free streets implementations.

Introduction

Worldwide there is a growing awareness about the positive effects of car-free urban settings on mitigating climate change outcomes through the reduction of traffic and related air pollution (Nieuwenhuijsen, 2016). In addition, car-free settings are known to improve public health outcomes by enhancing opportunities for a more active life, mobility, greater possibility for social inclusion, and supporting more liveable and functional neighbourhood development (Koglin, 2015; Naess and Vogel, 2012; Vogel, 2015; Cortinez-O'Ryan et al., 2017).

This relatively new way of thinking about car-free urban settings challenges the classic transport paradigm and suggests a shift towards a new mobility paradigm, from destination oriented to mobility as a precondition for societal inclusion, participation and quality of life (Banister, 2008; Newton, 2012). An important condition that can support the transition towards car-free cities seems to be the recognition that mobility is an integral part of our society rather than just understanding it as a movement from point A to B. Thus, mobility includes the underlying meaning and the embodiment of that movement as a particular practice as experienced by people, which is linked to cultural aspects as well as the urban form (Cresswell, 2010; Vogel, 2015; Koglin, 2017). As such, this transition taps into issues of social inclusion and transport justice. Therefore, in parallel to systemic changes and spatial rearrangements, it appears crucial to analyse the transition towards car-free (or car-reduced) cities from the perspective of the users of place. People embody the mobility patterns of their everyday lives and are

* Corresponding author at: Department of People and Society, Swedish University of Agricultural Sciences, PO Box 190, SE-234 22 Lomma, Sweden.
E-mail addresses: elizabeth.marcheschi@slu.se (E. Marcheschi), nina.vogel@slu.se (N. Vogel), anders.larsson@slu.se (A. Larsson), sapr0003@stud.slu.se (S. Perander), till.koglin@tft.lth.se (T. Koglin).

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therefore, the most affected by shifts in mobility systems, urban form, and cultural change (Valderrama Pineda and Vogel, 2014; Berger et al., 2014).

Nevertheless, the dominant mode of transport in contemporary planning is still the car and this condition excludes several groups in society that are not able to or do not want to own a car. The marginalisation of active modes of transport, such as walking and cycling, would need to be challenged, implying a re-discussion and further development towards more interconnected infrastructures (Koglin and Rye, 2014). With this in mind, it becomes crucial to think of and develop urban settings that can ensure accessibility of places, key destinations, and facilities for all groups in society.

Following the guidelines proposed by the European Commission in the sustainable urban mobility plans (SUMPs) and the health and environmentally sustainable goals proposed by the Agenda 2030 for Sustainable Development, several European cities have been involved in the development of strategies and interventions to support a shift towards car-free urban settings (European Commission, 2020). Some of these examples are more drastic and extreme than others such as, the attempts of Oslo, Helsinki, Hamburg, and Madrid in becoming partially car-free cities (Nieuwenhuijsen et al., 2019). Some other examples are proposing a more gradual shift towards car-free lives, by implementing temporary initiatives such as, car-free summer streets.

The focus of this work is on these latter examples of car-free interventions that gradually introduce and test measures to reduce car use. Thus, they can be defined as car-free street experiments putting forward a learning by doing approach (Bertolini, 2020). These types of interventions are often initiated as temporary changes in the public urban arena, which implies that they are easier to justify from a policy maker's perspective since they do not disrupt the overall motorised traffic planning of the city. Yet, they have the potential to form the basis for a longer-term discussion of systemic changes needed in the urban mobility systems (von Schönfeld and Bertolini, 2017; Caprotti and Cowley, 2017).

The development of car-free settings implies several changes in mobility patterns, such as shifts in modes of transport. One of those modes of transportation that gradually becomes more central in urban planning contexts is walking. Urban walking has been defined as a complex multifaceted phenomenon resulting by the interplay between physical and social characteristics of the urban setting (*external environmental factors*), as well as, by psychological and personal qualities of the individual (*internal psychological factors*) (Kärrholm et al., 2014). These latter, psychological factors (e.g emotional relations with place) are often neglected aspects of car-free settings' research since, traditionally, the focus has been on mobility patterns, environmental pollution and other types of social parameters (e.g. attitudes and behaviours).

Nevertheless, several studies have pointed out how emotional relations with place guide human responses and in turn affect attitudes, behaviours, and actual use of place (Lindelöw, 2016).

Thus, while so far the rationale behind car-free streets' research has shown the beneficial effects of car-free settings for our environment, health and social inclusive issues, a lack of knowledge about the above mentioned underlying individual factors is still found (Litman, 2003, Waygood and Friman, 2015).

These factors can be defined as *psychosocial processes,* which account for the emotional relationship between people and their environment, and are able to affect the individual's appraisal towards, for example, acceptance and use of car-free streets (Ferreira et al., 2016). Ferreira and colleagues (2016) have seen how emotional and social-relational factors intercede between people and their residential neighbourhood environment, shaping the experience of walking as well as the actual intention of being a part of the neighbourhood life. Furthermore, the feelings of attachment and identification with one's residential neighbourhood environment affect the level of satisfaction with the setting itself, and often, greater levels of attachment mirror greater participation and engagement in the neighbourhood setting (Bonaiuto et al., 2015).

However, it was also found that variations in the residential neighbourhood environment such as, changes in parking, structural design, or implementation of car-free interventions, impact people's affective experience of place (e.g. intention and attitudes towards walking) (Páez and Whalen, 2010). The extent to which such interventions are welcomed and accepted, or rather, experienced as disruptive for one's attachment, is still largely unknown when it comes to the specific case of car-free street experiments.

Thus, to engage in a transition towards more environmentally and socially friendly cities through the gradual implementation of car-free streets, we cannot neglect the role played by the individual emotional experience and relation with place (Iwarsson and Ståhl, 2003; Nieuwenhuijsen et al., 2019; Marcheschi et al., 2020).

The present study is part of a larger research project, which comprises analysis of political visions, car-free concept development, particular car-free interventions, and citizens' experiences and participation in these interventions. Thus, while the overall project seeks to gain a holistic and interdisciplinary understanding of the interplay between all aspects mentioned above, this specific study focuses on the perspective of the users of car-free streets and their level of acceptance and usability towards car-free street experiment implementations.

The overarching goal is to support municipalities and city planners with information about residents' perception of car-free street experiments so that informed decisions can be made with regard to the development or adaption of existing car-free residential neighbourhood settings.

Theoretical background

With the purpose of capturing people's perception of car-free street experiments, while accounting for the interplay between external residential neighbourhood environmental qualities and residents' internal psychosocial processes, the present study adopts the human environmental interaction model (HEI model) as the theoretical background (Küller, 1991; Marcheschi et al., 2020). The model has a long tradition of use across interdisciplinary studies addressing similar issues to those explored in this work, and it was chosen because it emphasises the centrality of the individual subjective experience (i.e. user-centred framework) as mediating the effects of the environment on well-being outcomes (Johansson, 2004; Mattsson et al., 2020).

Four dimensions (i.e. *physical environment, social environment, individual resources and activity of engagement*), one process (i.e. *psychosocial process*) and one outcome (i.e. *well-being*) compose the model (Marcheschi et al., 2020). Each dimension, process and outcome were operationalised based upon knowledge derived from the field of environmental psychology, landscape architecture, and traffic planning with the purpose of translating concepts and constructs into actual empirical data collection for car-free street experiments.

The dimensions of *physical and social environments* were accounted for, during the car-free experiments, and were operationalised in terms of environmental quality indicators acknowledged to affect well-being outcomes such as, aesthetic building architecture, traffic and noise, social life atmosphere and personal safety from traffic and crime (Tucker Cross and Küller, 2004; Borst et al., 2008; Van Cauwenberg et al., 2012).

Furthermore, the *activity* of engagement was operationalised in terms of a neighbourhood's accessibility during car-free street experiments. Accessibility results from the interaction between the degree to which mixed land use activities are easy to reach by residents, and the extent to which the same environment supports possibilities for social participation across diverse groups of society, including diverse types of functional abilities (Brownson et al., 2015).

The dimension of *individual resources* account for the individual's personal characteristics such as age and gender. It was therefore operationalised to comprise this type of general sociodemographic information, as well as, specific data expected to be of relevance for the case

of car-free street investigations such as distance to work or prior experiences with car-free street experiments.

Furthermore, the process that intercede between the model's dimensions and the study outcome was operationalised in terms of residents' perception of, *neighbourhood attachment and quality of life* (Burns, 1999; Lloyd and Auld, 2002; Marcheschi et al., 2015). Traditionally, these two constructs have been studied as outcomes, rather than psychosocial processes interceding between people and the environment since together they account for the affective and cognitive dimensions of subjective well-being (Pavot and Diener, 1993). However, as this study is a comparative case study rather than a longitudinal evaluation of the effects of car-free street implementations, it appeared more relevant to use the above-mentioned constructs of neighbourhood attachment and quality of life as potential interceding factors.

Neighbourhood attachment is a psychosocial construct developed from the umbrella concept of place attachment and it refers to the *emotional bond* established between a person and his/her place of residence (Manzo and Devine-Wright, 2014). Q*uality of life*, on the other hand, is a multi-dimensional phenomenon comprising the individual's evaluation of his/her position in life, with consideration for the context, the culture and the value system in which they live, and in relation to personal goals and expectations (World Health Organization Group, 1993).

The study outcome was operationalised in terms of *acceptance* towards car-free street experiments and *usability* of place. The concepts of acceptance and usability of a place are both important for social inclusion and transport justice (Banister, 2008; Martens, 2016; Martens and Lucas, 2018). Specifically, acceptance towards car-free streets in this present study refers to the degree to which residents are supportive of car-free interventions occurring in their residential neighbourhood setting (Küller and Laike, 1992). Usability, on the other hand, refers to the extent to which people perceived the possibility to perform activities of interest during car-free street experiments, as well as, actual observed behaviour of environmental usability during car-free streets experiments. Specifically, the individual's own perception of environmental usability is known to influence the quality and frequency of mobility, and related participation in the public arena, affecting, therefore, wellbeing outcomes (Banister and Bowling, 2004).

Method

Study design

A cross sectional study design was developed following the STROBE guidelines to investigate residents' perceptions of car-free street experiments across four different case studies located in two cities in Sweden, respectively, Malmö and Gothenburg (Cuschieri, 2019). The STROBE guidelines were used in order to support a transparent report of the study from its introduction to the methodology, the results and the discussion. Specifically, such guidelines provide a checklist of all items that should be included and presented in cross-sectional studies (e.g. introduction background and objectives, study design, settings, participants, variables, statistical analysis, descriptive and inferential results, key results, limitation and if possible generalizations).

Furthermore, the approach adopted comprises the merging of knowledge from different disciplines (i.e. environmental psychology, mobility and traffic planning, and landscape architecture) resulting in a mixed method of investigation. Experts', residents' and users' of place perspectives are accounted for by means of environmental audit tool evaluations, self-report measures, observations and interviews (*technical and observed based environmental assessments*) (Gifford, 2014).

Settings

Four car-free streets settings defined as summer streets were selected and investigated; two streets were located in the city of Malmö, and two in the city of Gothenburg. Koglin et al. (2019) provides a detailed description of the car-free summer street concepts and implementations investigated in this study. Specifically, the car-free streets programs investigated in this work focuses mainly on developing a setting that is supportive for pedestrian rather than cyclists.

Description of the physical environment of car-free summer street experiments in Malmö

Friisgatan

Car-free experiments in Friisgatan are regulated from April 1st to September 30th and the dialogues between the municipality, visitors, residents, and entrepreneurs have been ongoing since 2016 (Fig. 1). The street consists of apartments and businesses (i.e. cafés, restaurants, shops) and it is located in the central parts of Malmö. The buildings that line the street are about six storeys high and of mixed character, from the late 19th century until modern times.

The streets are close to a metro-station, bus stops, and shops, well connecting different city neighbourhoods, which is why several bikers and e-scooters can be seen in the street during car-free experiments while pedestrians are using the sidewalks.

Cleasgatan

Summer-street experiments in Cleasgatan are regulated from April 1st to September 30th and its first implementation started in 2019 (Fig. 2). The street is central despite being situated further away from the central parts of Malmö if compared to Friisgatan. The street consists of modern buildings from the sixties and seventies, approximately six storeys high, with shops and a pub. The street has no ordinary sidewalks, but it has been given a more permanent redesign where areas for sitting and plants can be found. This provides opportunity to experience the street as a social meeting place for residents and visitors of different cultural backgrounds.

Description of the physical environment of car-free summer streets in Gothenburg

Tredje Långgatan

Tredje Långgatan has been regulated as a car-free summer street between May 1st to September 30th since 2015, and the initiative came originally from restaurants (Fig. 3). The streets have some green features and seats, however, transport of goods is quite dominant during daytime, when the street also functions as a thoroughfare for cyclists and pedestrians, while the street becomes more alive during evenings.

Tredje Långgatan is located just outside the most central parts of Gothenburg with buildings from the end of the 19th century that coexist with newer buildings approximately 6 storeys high. The street can be seen as a prolongation of the attractive Haga Nygata, a very popular pedestrian street with carefully renovated buildings from the 19th century.

Teatergatan

The first summer street experiment for Teatergatan took place in 2019 between May 1st to September 30th (Fig. 4). The initiative was driven as a municipal top-down project of a slightly different character than the other streets mentioned above. A two-way street has been transformed into a one-way street and parking spaces along one of the sidewalks have been converted into park-let activities, such as furniture for sitting and temporary planting boxes. Thus, Teatergatan still functions mainly as a thoroughfare, but with less traffic and places to rest along the street. Teatergatan runs one block away from the main parade street of Gothenburg called "Kungsportsavenyn". Buildings are of a mixed character and height (i.e 3–6 storeys), ranging from older brick buildings to more modern buildings, where the latter are arranged in quite compact blocks consisting of shops, restaurants and apartments. There are sidewalks on both sides, and the whole area is currently under renovation.

Fig. 1. Friisgatan photo taken by Vogel, 2019.

Fig. 2. Cleasgatan photo taken by Vogel, 2019.

Participants

The study sees the involvement of three types of participants, experts, residents and users of place.

The experts (N = 5) belong to the field of environmental psychology, landscape architecture, and traffic planning and have performed environmental audit tool evaluations, observations, and walk-bike-through interviews. Specifically, their evaluation through the audit tool check list seek to provide a detailed a more objective picture of the physical and social environmental qualities present in place during car-free streets experiments, across the different cases investigated. Such information is considered of relevance to provide a description of the environments in which the experiments are performed and thus, providing support for further discussions about what might have played a crucial role into the acceptance of car-free streets implementations.

A convenience sample of residents (N = 1049) of which 54% were female (N = 557) and 46% were Male (N = 483) (age M = 52 SD = 17.7) (overall response rate of 28%) participated in the study. Approximately, 60% of the residents have lived in the neighbourhood for more than 5 years and 35% of them live directly on a car-free street whereas the

Fig. 3. Tredje Långgatan photo taken by Vogel, 2019.

Fig. 4. Teatergatan photo taken by Vogel, 2019.

remaining 65% live within the same neighbourhood (i.e. city blocks within the nearest main street). More than half of the residents participating in the study did not have any children (62%). Moreover, users of place, such as pedestrians and bikers, were also included in the study (N = 90) (Malmö N = 39, Gothenburg N = 51).

The residents were recruited by selecting the area of interest in which the car-free street experiment was performed and were contacted by post mail with a questionnaire that was sent by the company Parajett during the summer of 2019. The questionnaires were submitted a first time in June 2019, and then a reminder in August 2019.

Finally, users of place (i.e. pedestrians and bikers) (N = 90) comprise those individuals that were present in place during the experts' evaluations and were willing to share their experience by means of walk-bike-through interviews (Malmö N = 39, Gothenburg N = 51).

Residents' questionnaires and walk-bike-through interviews were all anonymous.

Instruments/Variables

An *environmental audit tool* was used to collect information about

physical and social environmental qualities of the residential neighbourhood settings in which car-free street experiments were implemented (Tucker Cross, 2007).

The tool resembles that of a checklist composed by (N = 80) quality indicators presented on 4-point Likert scale, where '1′ means, no presence of the indicator and '4′ means complete presence of the indicator. The instrument produces 11 environmental quality indices encompassing different physical and social environment domains (i.e. planning, building architecture, aesthetics, design, greenery, accessibility, outdoor climate, traffic and noise, personal safety, maintenance, social life and commercial activities at place) (Cronbach's $\geq$ 0.70). Experts (N = 3) from the research team evaluated each car-free street and agreement between them was calculated by means of Fleiss' kappa (K >. 20), which it is estimated to be fair in consideration of the interdisciplinary background of the experts and the variation among the streets evaluated (Field, 2009).

Self-report measures were developed to capture residents' perceptions of car-free street experiments and comprised the following information:

- *Sociodemographic data* (i.e age, gender, children, type of living accommodation, length of living arrangement, familiarity with car-free street experiments, distance to work, car ownership, identity perception). No information about ethnicity was collected.
- *Perceived acceptance towards car-free streets* composed by averaging the results of items (N = 2), presented on a 5-point Likert scale ('1′ means totally disagree and '5′ means totally agree). One of the two items was reversed ahead of calculation (Cronbach's, α = 0.74) (Küller and Laike, 1992).
- Perceived *usability* of place composed by one overarching item presented on a 5-point Likert scale ('1′ means totally disagree and '5′ means totally agree) (Mattsson et al., 2020).
- *Perceived predictors of car-free street experiment acceptance* are composed by the following items; positive atmosphere and quality of social life (N = 2) (Tucker Cross and Küller, 2004).
- *Neighbourhood attachment Scale (NAS),* composed by 4 items on a 5-point Likert scale ('1′ means totally disagree and '5′ means totally agree). One of the 4 items was reversed ahead of calculation (Cronbach's, α = 0.79) (Fornara et al., 2010).
- *Perceived quality of life* was accounted for with the short version of the satisfaction with life scale, which is obtained by averaging 5 items presented on a 5-point Likert scale ('1′ means totally disagree and '5′ means totally agree) *(*SWLS) (Cronbach's, α = 0.79) (Pavot and Diener, 1993; Saelens et al., 2003).

Observations

Data about to the study outcome, of actual usability of place, referring to the amount of people found interacting in place during car-free streets experiments, was collected by means of observations.

A total of (N = 73) observations were performed in place by the research team (N = 5), (Malmö N = 36, Gothenburg N = 37). The observations were performed at different times during the day (i.e. morning, afternoon and evenings, between 8:00–16:00) and the time length of each observation was 15 min. Each observation adopted an incident time sampling technique, implying that any interaction occurring in the environment during the time frame of the observation was recorded (e.g. people passing by, people interacting) (Marcheschi et al., 2016). A total of (N = 8318) observed interactions were recorded, of which (N = 5648) were observed in Malmö and (N = 2670) in Gothenburg.

Walk-through and bike through interviews

Walk-through and bike-through interviews were done to collect qualitative data regarding users' perception of physical and social environmental aspects (i.e. facilitators and hinderers) of car-free streets settings. A total of (N = 39) interviews were performed in Malmö, of which (N = 34) were pedestrians and (N = 5) were bikers. Gothenburg had a total of (N = 51) interviews of which (N = 47) were pedestrians and (N = 4) were bikers.

Two main questions were used respectively; what was experienced to be positive with car-free street experiments and what could be improved in the physical and social environment of the car-free street in question.

Statistical methods and analysis

Missing values on single scales were replaced by the series mean for the experts' environmental audit tool and residents' self-report questionnaire (missing values comprised between 10% and 15%). The only exception were 2 items from the environmental audit tool that had missing values above 15% and, due to irrelevance of their content for this study, were removed (i.e. items about illumination and social life at night). Normal data distribution was attained across all instruments implemented in this study with the exception of a single item accounting for perceived usability (Skewness and Kurtosis > ±2) of car-free streets which was deleted since data on usability was obtained through other means (i.e. observed usability of place) (Field, 2009). The study is cross-sectional (i.e. all data collected during the summer 2019) and comparisons between the cases were performed by means of *t*-test and analysis of variance (ANOVA) statistical procedures, to see potential variations in terms of acceptance and usability. Given that homogeneity of variance was met, REGWQ and Tukey's HSD post hoc tests were used for the pairwise comparison after ANOVA, to identify potential differences across the cases investigated. The effect size of significant results accounting for the study outcome (i.e. acceptance) and the psychosocial processes of (i.e. neighbourhood attachment and quality of life) were calculated by means of eta-squared (range 0–1.) (Pierce, Block and Aguinis, 2004). Furthermore, hierarchical regression analysis was used to test the extent to which residents' perception of a positive atmosphere and the quality of social life account for acceptance towards car-free experiments implementations.

The data was first coded into Excel and then for the statistical analyses the statistical program SPSS (Statistical Package for the Social Sciences for Windows, version 21) was used. The p-value criterion for significance was set at $p \leq 0.05$.

Ethical considerations

The study was developed and performed in collaboration with the municipalities of Malmö and Gothenburg, which have helped in the selection of the appropriate car-free street experiments (i.e. summer streets).

The study did not require ethical approval since the participants of the study were over 18 years old and no sensitive information was asked. The data was anonymous, implying that the researchers did not have access to the names and/or addresses of the respondents. A company (Parajett) was hired for the purpose of submitting the questionnaire via post mail to the areas selected (i.e. summer streets and the neighbourhood city blocks within the nearest main street). Access to the data was provided exclusively to the researchers involved in the study for analysis purposes (coding and analysis in Excel and SPSS). Furthermore, the original material (i.e. paper questionnaires) are stored in a safe belonging to the principle investigator of the study.

Results

The following section comprises results addressing, physical and social environmental quality differences between the car-free streets experiments, as reported by experts' evaluation, residents' level of acceptance and usability across the different experiments, and the influence of perceived quality of social life on acceptance levels towards car-free streets implementations. Furthermore, the role played by

neighbourhood attachment and perceived quality of life in affecting the level of acceptance of car-free streets, is reported.

Finally, the influence of sociodemographic factors and familiarity with previous car-free streets interventions on psychosocial processes and acceptance towards car-free streets experiments is presented.

Experts' results on physical and social environmental qualities differentiate across the four car-free street experiments

Overall, these results showed significant variations in terms of physical and social environmental quality indicators across the streets. Malmö had the highest and lowest scores, whereas Gothenburg showed more stable results across the two car-free streets examples.

The car-free street experiment that scored consistently higher than the rest is Friisgatan whereas; Cleasgatan and Teatergatan reported the lowest scores.

Significant differences were found about the quality of *buildings and architecture,* Friisgatan (N = 3) (M = 3.3, SD = 0.43, range 1–4) scored significantly higher than Claesgatan (N = 3) (M = 2.7, SD = 0.47, range 1–4), F (1;3) = 5,046, p <.05. Furthermore, significant differences were found for place accessibility, Friisgatan (N = 3) (M = 2.8, SD = 0.16, range 1–4) scored again significantly higher than Claesgatan (N = 3) (M = 2.2, SD = 0.35, range 1–4), F (1;3) = 4,660, p <.05. Also, Friisgatan (N = 3) (M = 3.3, SD = 0.61, range 1–4) had significantly higher scores about personal safety in comparison to Claesgatan (N = 3) (M = 2.1, SD = 0.41, range 1–4), F (1;3) = 4,788, p <.05. The following is an overview of the significant differences and a graphical representation of the scores reported across the four car-free street experiments (Fig. 5).

Acceptance levels and usability of car-free street experiments

At large, the results suggest that residents of both cities had a more positive than negative attitude of acceptance towards car-free street experiments. The higher acceptance levels were reported by the residents of Claesgatan in Malmö (N = 184, M = 4.38, SD = 0.98, range 1–5) and the lowest by the residents of Teatergatan in Gothenburg (N = 284, M = 3.18, SD = 1.3, range 1–5). The analysis of variance and related post hoc tests showed a consistently significant higher level of acceptance towards car-free streets in Malmö than in Gothenburg (F (1, 3) = 49.68, p =.000, η2 = 0.12).

Furthermore, when looking at the results of the observations, which account for the level of usability of car-free streets, the results suggest that case studies of Malmö had higher usability than Gothenburg (Table 1).

Environmental quality indicators predicting residents' acceptance towards car-free streets

Two factors were tested as predictors of acceptance towards car-free streets experiments respectively, perceived positive atmosphere and quality of social life during car-free street experiments. These latter variables account for the perceived quality of social interaction experienced in place. Together these factors explained 34% of the variance with regard to residents' acceptance towards car-free streets implementations (Table 2). Also, descriptive statistics of residents' perception of positive atmosphere and quality of social life across shows slightly greater values in Malmö then Gothenburg (Table 3).

Furthermore, the results from walk-bike-through interviews (N = 73) resulted in (N = 36) positive outcomes and (N = 37) potential for improvements. Among the positive aspects experienced during car-free streets are: the opportunity to experience a nicer outdoor setting with restaurants and activities on the street, lively city life, better air quality, fewer noises from traffic, safer to walk and more accessible for vulnerable groups (i.e. elderly and children).

On the contrary, the suggested improvements are: a clear separation between pedestrians and other transport modes (e.g. bikers, electric-scooters), clearer signs about car-free zones to avoid car traffic and, improvements with regard to parking opportunities nearby.

Residents' neighbourhood attachment and quality of life in the car-free street experiments

The results suggest that, overall, the levels of neighbourhood attachment and quality of life are more positive than negative. However, significant differences can be found regarding the city of Malmö and Gothenburg. With regard to neighbourhood attachment, both residents of the car-free street experiment evaluated in Gothenburg Tredjelångatan (N = 242, M = 3.92, SD = 0.90) and Teatergatan (N = 287, M = 3.96, SD = 0.88, range 1–5) reported higher degree than Malmö Claesgatan (N = 129, M = 3.41, SD = 1.0, range 1–5) F (1, 3) = 10,719, p =.000 η2 = 0.03).

Similar results were found with regard to quality of life, where Gothenburg and especially Teatergatan (N = 287, M = 4, SD = 0.853, range 1–5), reported higher scores when compared to Claesgatan (N = 129, M = 3.31, SD = 0.914, range 1–5) F (1, 3) = 21,926, p =.000 η2 = 0.06).

In addition, an overall negative correlation was found between perceived quality of life and levels of acceptance towards car-free streets implementations (r (992) = −113, p <.001).

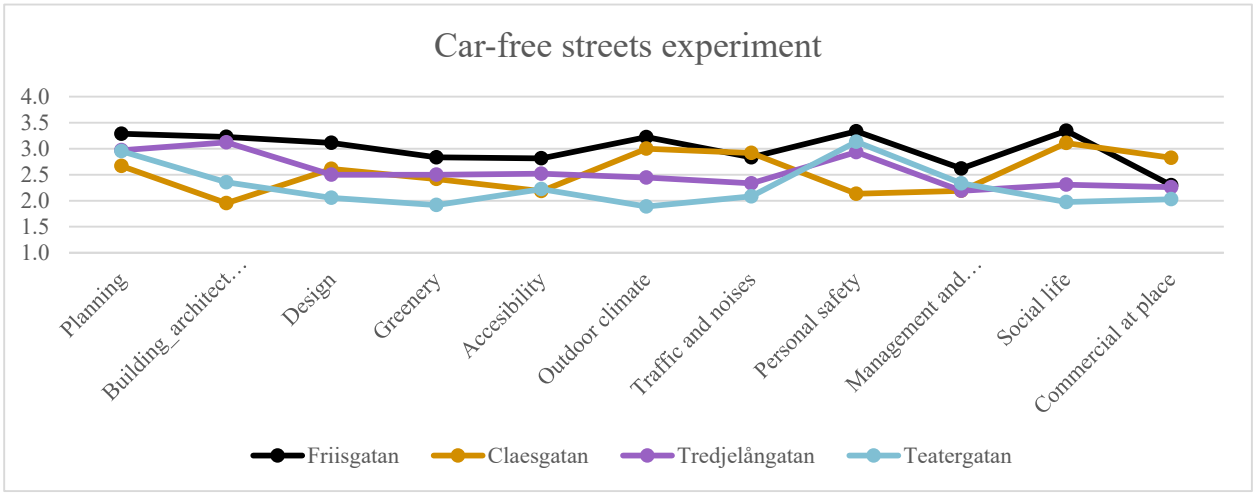

Fig. 5. Environmental quality differences across the four car-free street experiments.

Table 1
Observation of place usability (i.e. four car-free street experiments).

City	Observations	Time	Interactions	Bikes	Electric scooters	Cars
Malmö	N = 36	8:00–16:00	N = 5648	N = 1119	N = 41	N = 159
Gothenburg	N = 37	8:00–17:00	N = 2670	N = 357	N = 17	N = 181
Total	N = 73					

Table 2
Hierarchical regression analysis with acceptance as dependent variable and the items of positive atmosphere and quality of social life as predictors (N = 910).

Step 1	B	SE B	B
Constant	1.977	0.096	
positive atmosphere	0.522	0.025	0.565
Step 2			
Constant	1.739	0.104	
positive atmosphere	0.345	0.041	0.374
Quality of social life	0.237	0.043	0.242

Notes: R2 = 0.32 for step 1 (p <.001), ΔR2 = 0.34 for step 2 (p <.001).
(*p <.05, **p <.01, ***p <.001).

Table 3
Residents' perception of positive atmosphere and quality of social life reported number of responses, mean values, and standard deviations.

Name of street	**N**	**M**	**SD**
Friisgatan (Malmö) Positive atmosphere	352	3,93	1,3
Claesgatan (Malmö) Positive atmosphere	115	3,78	1,2
Tredjelångatan (Gothenburg) Positive atmosphere	219	3,47	1,3
Teatergatan (Gothenburg) Positive atmosphere	238	2,74	1,4
Total	924		1,4
Friisgatan (Malmö) Social life	352	3,98	1,2
Claesgatan (Malmö) Social life	116	3,92	1,1
Tredjelångatan (Gothenburg) Social life	217	3,70	1,3
Teatergatan (Gothenburg) Social life	236	2,91	1,3
Total	921	3,63	1,3

Sociodemographic factors influence on psychosocial processes and level of acceptance

Differences were found on the acceptance levels towards car-free implementations and gender. Females (N = 527) had greater acceptance towards car-free street implementation than men (N = 462) respectively; (M = 3.90, SD = 1.2; M = 3.74, SD = 1.3) t (987) = 1.99, p <.05. Women, also had significantly higher levels of neighbourhood attachment than men did respectively; (M = 3.87, SD = 0.98; M = 3.75, SD = 0.95), t (995) = 1.91, p =.05.

Furthermore, higher levels of neighbourhood attachment were found for residents of over 5 years (N = 634, M = 3.98, SD = 0.92) if compared to a few months (N = 56, M = 3.37, SD = 1.0) or 1 to 5 years (N = 302, M = 3.59, SD = 0.98), F (1; 3) = 12.42, p =.000.

However, living in place longer also corresponded to lower acceptance levels towards car-free street implementations (i.e. residents more than 5 years, N = 634, M = 3.68, SD = 1.3) and residents between 1 and 5 years, N = 302, M = 3.99, SD = 1.3), F (1; 3) = 3.89, p =.05).

No significant results were found with regard to familiarity with car-free street implementations and acceptance levels (t [1025] = 0.308, p >.05). However, living on the actual street of car-free experiments (N = 337, M = 3.95, SD = 1.2) corresponded to greater levels of acceptance towards their implementation than living nearby (N = 643, M = 3.77, SD = 1.2), t (978) = 2.01, p <.05.

Finally, car owners reported a lower level of acceptance towards car-free streets (M = 3.4, SD = 1.3, range 1–5) when compared to those who responded that did not own a car (M = 4.3, SD = 1.0, range 1–5), t (1033) = 12, 30, p =.000. Also, the group of respondents that identify themselves as being car drivers (N = 255) reported significantly lower levels of acceptance towards car-free implementations (M = 2.87, SD = 1.3, range 1–5) than the group of respondents that did not define themselves as car-drivers (N = 772) (M = 4.12, SD = 1.1), t (389) = 13, 71, p =.000.

Discussion

This study seeks to increase our understanding about environmental factors (i.e. physical and social) and psychosocial processes that might play a crucial role in affecting the level of acceptance towards car-free street implementations and the degree of place usability.

The novelty of this work resides in the focus on people's perceptions during car-free street experiments, which is expressed in terms of perceived environmental qualities (i.e. positive atmosphere and quality of social life) and emotional relations to place (i.e. psychosocial processes of neighbourhood attachment and quality of life).

Often, these latter psychosocial processes have been overlooked within research on car-free measures and implementations or have been seen exclusively as positive outcomes of the sustainable mobility vision for environmental and health purposes. However, research findings from people-environment studies have suggested that emotional bonds between individual and place might actually have negative effects on sustainable measures' implementation in the environment (e.g. NIMBY process) (Devine-Wright, 2009; Devine-Wright and Howes, 2010).

Despite the overall results showing relatively positive attitudes towards car-free measures across the four cases investigated, a negative correlation between perceived quality of life with residents' levels of acceptance towards such experiments was found. Also, an association between levels of attachment and acceptance towards car-free street was highlighted, which appear to suggest that greater levels of attachment might be a hinder towards residents' attitudes about car-free street implementations in their neighbourhood.

From a theoretical perspective, this highlights how residents with high levels of attachment and perceived quality of life, appear to be more prone to evaluate any changes in their neighbourhood environment as potential threats to their life balance. This disruption in place attachment is a psychological phenomenon that develops due to an outward disturbance causing an interruption of a known relation with place (Devine-Wright and Howes, 2010). In the case of car free street implementations altering the use of place, the mobility patterns and the parking availability are affected. Such experiences, if not well managed by the individual through mature coping strategies can develop into oppositional attitudes and behaviours (Korpela, 1989; Fried, 2000; Devine-Wright and Howes, 2010).

This potential experience of disruption with place during car-free street experiments could be explained by the lack of behavioural engagement with the actual place in which the interventions were performed. As a matter of fact, low usability of place was observed in Gothenburg, where the highest scores for attachment and quality of life are reported, and the lowest scores for acceptance towards car-free streets are shown. The latter can be of relevance for municipalities and city planners in different ways. For example, one could gather information like this study to target those locations in the city in which the usability of the place welcomes further interventions and reinforces the place's quality as a meeting place (Bertolini, 2020). On the other hand, static people-environment relations can be improved or shifted towards different people-environment interplays by appropriate strategies of intervention, proper support, communication, and participation between municipalities and residents when carrying out real life

experiments.

This latter scenario, would open up the possibility of discussing the potential positive effects of environmental changes and of disrupting old attachment patterns in favour of new and more sustainable way of living, introducing new opportunities for environmental and health progress. Raymond and colleagues (2017) discuss this opportunity in terms of a meaning making process between people and the environment, which is achieved through suitable accommodations provided to people while interacting with their everyday life setting. Lewicka (2011) further defines this process in terms of '*embodied cognition*', stressing the increased interest of society towards the development of a new paradigm to understand people and place emotional relations in which meaning emerges from the constant and dynamic interactions with the environment and the opportunities this later provides.

The methods and the findings from this study can support the development of a meaning making process as they provide information to policy developers and car-free street designers to establish diverse approaches across cases. Following this line of informed decision-making, better possibilities are provided to meet the different contextual conditions and to engage residents and visitors of those places effectively.

Nevertheless, with consideration for the complexity and interrelated dynamics that develop between people and their everyday life setting, it is important to point out the need for also taking into consideration the socio-economic context, the local cultural conditions, ethnicity, and even political climate (von Schönfeld and Bertolini, 2017). Investigations that triangulate our findings by taking a closer look at who is driving such transformative changes and who might not be represented are thus recommended, in order to avoid inequality and gentrification challenges.

In this study, only certain socio-demographic information were considered and of those only a few aspects were found to be significantly relevant for successful implementation of car-free streets respectively; gender (i.e. women) and length of living in place (i.e. between 1 and 5 years). Further, the results about a person's identity as a car driver showed significant effects on the levels of acceptance towards car-free implementation as well as car ownership. Both resulted in significantly lower acceptance. This stresses again the importance of including residents' perception as our belief systems affect our acceptance and consequent behaviour (e.g. bottom up process and co-design approaches).

The experts' evaluations of physical environmental qualities of car-free street settings showed that greater physical environmental quality does not seem to play a crucial role for residents' levels of acceptance and usability of car-free streets. Instead, the creation of places that support social interactions and positive social atmosphere, rather than functioning as a passing through corridor, increase acceptance for interventions. The decisive part in this study was the car-free street characteristic of being an actual or potential meeting place. Such place quality was pivotal and created a positive response to car-free measures and as such, the interventions acted as reinforcement for the place characteristics and usability.

Overall, the results from this work suggest that accounting for the quality of individuals' emotional relation with place can provide insights regarding what setting to select, or the most feasible strategy to adopt. Furthermore, the inclusion of people's perceptions can also provide some practical information about actual physical environmental features. For example, from the walk-bike-through results, it appears clearly that safety issues are very central. Pedestrians did not feel safe to walk in the middle of car-free streets due to the lack of separation between pedestrians and cyclists, as well as due to cyclists' and e-scooters' speed levels. Municipalities and planners might want to consider the possibility of either creating separation between these non-motorised modes of transport or by clearly creating rules in which shared space is also matched with shared speed.

A potential limitation of the study lays in the nature of the study itself, cross sectional, and the consequent statistical analysis possibilities. However, the variation among the cases in terms of neighbourhood environmental qualities led the research team to decide for certain statistical analysis rather than others. Future investigation might want to consider the possibilities to collect a greater amount of data, perhaps from one single case, to provide opportunity for the investigation of causal relationships between variables. Thus, the invitation for future investigations is to further develop a model (e.g. structural equation modelling), per which the insights derived from this exploratory type of study, could be tested in a more confirmatory manner.

To conclude, the car-free street experiments investigated serve as a context for learning where municipalities could use the expertise of residents to improve the design and delivery of car-free street interventions. At large, learning is key to any experimental approach and forms capacity towards systemic changes (Sengers et al., 2019). This work seeks to contribute to this continuous process of learning, to realise a transition towards more sustainable urban mobility and quality of public spaces at a neighbourhood scale, by integrating psychosocial and socio-physical environmental knowledge that can support informed decision making while creating meaningful processes between residents and municipalities.

Conclusion

The study compared four car-free street urban experiments for the purpose of increasing understanding about relevant environmental quality indicators that appear to be supportive for residents' levels of acceptance towards car-free street implementations. The psychosocial processes of neighbourhood attachment and quality of life affect the level of acceptance and usability of car-free streets. In particular, two aspects had a significant effect, the site's quality as a meeting place that embraced interventions as reinforcing such qualities, and the perceived disruption in place attachment that led to rejection or reserved responses to change. This study stresses the value of including people's perceptions in informed decision-making processes concerning the design and introduction of those interventions. As such, urban street experiments can be understood in their complexity and multivalent character. This experimental approach ideally supports a professional and personal learning process for municipalities and users of those sites and helps in assessing and developing strategies towards more sustainable urban development.

CRediT authorship contribution statement

Elizabeth Marcheschi: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Project administration, Writing – original draft, Writing – review & editing. **Nina Vogel:** Conceptualization, Investigation. **Anders Larsson:** Conceptualization, Investigation. **Sonja Perander:** Methodology. **Till Koglin:** Conceptualization, Investigation, Funding acquisition.

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.

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References

Banister, D., Bowling, A., 2004. Quality of life for the elderly: the transport dimension. Transp. Policy 11 (2), 105–115.
Banister, D., 2008. The sustainable mobility paradigm. Transp. Policy 15 (2), 73–80.

Berger, G., Feindt, P.H., Holden, E., Rubik, F., 2014. Sustainable Mobility—Challenges for a Complex Transition. J. Environ. Plann. Policy Manage. 16 (3), 303–320. https://doi.org/10.1080/1523908X.2014.954077.
Bertolini, L., 2020. From "streets for traffic" to "streets for people": can street experiments transform urban mobility? Transp. Rev. 40 (6), 734–753.
Bonaiuto, M., Fornara, F., Ariccio, S., Ganucci Cancellieri, U., Rahimi, L., 2015. Perceived Residential Environment Quality Indicators (PREQIs) relevance for UN-HABITAT city prosperity index (CPI). Habitat Int. 45, 53–63.
Borst, H.C., Miedema, H.M.E., de Vries, S.I., Graham, J.M.A., van Dongen, J.E.F., 2008. Relationships between street characteristics and perceived attractiveness for walking reported by elderly people. J. Environ. Psychol. 28 (4), 353–361.
Brownson, R., Hoehner, C., Day, K., Forsyth, A., Sallis, J.F., 2015. Measuring the built environment for physical activity. Am. J. Prev. Med. 36 (4), 99–123.
Burns, P.C., 1999. Navigation and the mobility of older drivers. Journal of 29. Gerontology 54 (1), 49–55.
Caprotti, F., Cowley, R., 2017. Interrogating urban experiments. Urban Geogr. 38 (9), 1441–1450. https://doi.org/10.1080/02723638.2016.1265870.
Cortinez-O'Ryan, A., Albagli, A., Sadarangani, K.P., Aguilar-Farias, N., 2017. Reclaiming streets for outdoor play: A process and impact evaluation of "Juega en tu Barrio" (Play in your Neighbourhood), an intervention to increase physical activity and opportunities for play. PLoS ONE 12 (7).
Cresswell, T., 2010. Towards a politics of mobility. Environ. Plann. D: Soc. Space 28, 17–31.
Cuschieri, S., 2019. The STROBE guidelines. Saudi J. Anesthesia 13 (Suppl 1), 31–34.
Devine-Wright, P., 2009. Rethinking NIMBYism. J. Commun. Appl. Social Psychol. 19, 426–441.
Devine-Wright, P., Howes, Y., 2010. Disruption to place attachment and the protection of restorative environments: A wind energy case study. J. Environ. Psychol. 30 (3), 271–280.
European Commission, 2020. Sustainable Urban Mobility Plans (SUMPs). Retrieved: https://ec.europa.eu/transport/themes/urban/urban-mobility/urban-mobility-actions/sustainable-urban_en.
Ferreira, I.M., Johansson, M., Sternudd, C., Fornara, F., 2016. Transport walking in urban neighbourhoods—Impact of perceived neighbourhood qualities and emotional relationship. Landscape Urban Plann. 150, 60–69.
Field, A. (3rd Eds.), 2009. Discovering Statistics using SPSS. London: Sage.
Fornara, F., Bonaiuto, M., Bonnes, M., 2010. Cross-Validation of Abbreviated Perceived Residential Environment Quality (PREQ) and Neighbourhood Attachment (NA) Indicators. Environ. Behav. 20 (10), 1–26.
Fried, M., 2000. Continuity and discontinuity of place. J. Environ. Psychol. 20, 193–205.
Gifford, R., 2014. Environmental Psychology Principle and practice (5th Ed.). Colville, CA: Optimal Books.
Johansson, M., 2004. Psychological motivation of pro-environmental travel behaviour in an urban area. In: Traffic & Transport, Rothengatter, T., Huguenin, R D. (Eds).
Koglin, T., 2015. Vélomobility and the politics of transport planning. GeoJournal 80 (4), 569–586.
Koglin, T., 2017. Urban mobilities and materialities – A critical reflection of a "sustainable" development project. Appl. Mobil. 2 (1), 32–49.
Koglin, T., Rye, T., 2014. The marginalisation of bicycling in Modernist urban transport planning. J. Transp. Health 1 (4), 214–222.
Koglin, T., Vogel, N., Perander, S., Larsson, Marcheschi, 2019. Implementation of car-free districts: A document study from an international, national, regional and local perspective [in Swedish]. Nationellt kunskapscentrum för kollektivtrafik. K2 report 2019:8.
Korpela, K.M., 1989. Place identity as a product of environmental self-regulation. J. Environ. Psychol. 9 (3), 241–256.
Kärrholm, M., Johansson, M., Lindelöw, D., Ferreira, I.A., 2014. Interseriality and different sorts of walking: suggestions for a relational approach to urban waking. Mobilities 1–16.
Küller, R., 1991. Environmental assessment from a neuropsychological perspective. 10 In: T. Gärling and G. W. Evans, (Eds.). Environment, Cognition, and Action. Oxford 11 University Press, New York, pp. 78–95.
Küller, R., Laike, T., 1992. Metamorphosis in traffic behavior. In: Arisitidis, A., Karaletsou, C., Tsoukala, K. (Eds.), Socio-environmental Metamorphoses: Builtscape, Landscape Ethnoscape, Euroscape (Proceedings 12th International Conference of the IAPS). Aristotle University of Thessaloniki.
Iwarsson, S., Ståhl, A., 2003. Accessibility, usability and universal design— 22 positioning and definition of concepts describing person-environment relationships. 23. Disabil. Rehabil. 25 (2), 57–67.
Lewicka, M., 2011. Place attachment: how far have we come in the last 40 years? J. Environ. Psychol. 31 (3), 207–230.
Litman, T., 2003. Social Inclusion as a transport planning issue in Canada, Contribution to the FIA Foundation G7 Comparison Paper, presented at the European Transport Conference held in Strasbourg in June, 2003.
Lindelöw, D., 2016. Walking as a transport mode: Examining the role of preconditions, planning aspects and personal traits for the urban pedestrian Lund.
Lloyd, K.M., Auld, C.J., 2002. The Role of Leisure in Determining Quality of Life: 26 Issues of Content and Measurement. Soc. Indic. Res. 57 (1), 43–71.
Manzo, L.C., Devine-Wright, P., 2014. Place attachment advances in theory, methods and applications. Routledge, Abingdon, Oxon (UK).
Marcheschi, E., Johansson, M., Brunt, D., Hansson, L., Laike, T., 2015. Quality of life and place attachment among people with severe mental illness. J. Environ. Psychol. 41, 145–154.
Marcheschi, E., Johansson, M., Laike, T., Brunt, D., 2016. Housing design and people with severe mental illness. An observational approach to the investigation of supported housing facilities. Scand. J. Psychol. 57 (1), 12–21.
Marcheschi, E., Ståhl, A., Almén, M., Johansson, M., 2020. A theoretical model for urban walking among people with disabilities. Front. Psychol. 11, 156.
Martens, K., 2016. Transport Justice – Designing Fair Transportation System. Routledge, New York.
Martens, K., Lucas, K., 2018. Perspectives on transport and social justice. In: Handbook on Global Social Justice, Craig (Ed.), Elgar, Cheltenham, pp. 351–370.
Mattsson, P., Johansson, M., Almén, M., Laike, T., Marcheschi, E., Ståhl, A., 2020. Improved Usability of Pedestrian Environments after Dark for People with Vision Impairment: an Intervention Study. Sustainability 12 (3), 1096. https://doi.org/10.3390/su12031096.
Naess, P., Vogel, N., 2012. Sustainable urban development and the multi-level transition perspective. Environ. Innov. Soc. Transit. 4, 36–50.
Newton, P.W., 2012. Liveable and Sustainable? Socio-Technical Challenges for Twenty-First Century Cities. J. Urban Technol. 19 (1), 81–102. https://doi.org/10.1080/10630732.2012.626703.
Nieuwenhuijsen, M., 2016. Urban and transport planning, environmental exposures and health new concepts, methods and tools to improve health in cities. http://ehjournal.biomedcentral.com/articles/supplements/volume-15-supplement-1.
Nieuwenhuijsen, M., Bastiaanssen, J., Sersli, S., Owen, E., Waygood, D., Khreis, H., 2019. Implementing car-free cities: rationale, requirements, barriers and facilitators. In: Integrating human health into urban transport planning, Spring Nature 2019 M. Nieuwenhuijsen, H. Khreis (Eds.), New York: Springer International Publishing AG.
Van Cauwenberg, J., Van Holle, V., Simons, D., Deridder, R., Clarys, P., Goubert, L., Nasar, J., Salmon, J., De Bourdeaudhuij, I., Deforche, B., 2012. Environmental factors influencing older adults walking for transportation: a study using walk-along interviews. Int. J. Behav. Nutr. Phys. Activity 85 (9), 1–11.
Páez, A., Whalen, K., 2010. Enjoyment of commute: a comparison of different transportation modes. Transp. Res. Part A 44 (7), 537–549.
Pavot, W., Diener, E., 1993. Review of the Satisfaction with Life Scale. Social Indic. Res. Ser. 39, 101–117.
Pierce, C.A., Block, R.A., Aguinis, H., 2004. Cautionary note on reporting eta-squared values from multifactor anova designs. Educ. Psychol. Measur. 64 (6), 916–924.
Sengers, F., Wieczorek, A.J., Raven, R., 2019. Experimenting for sustainability transitions: a systematic literature review. Technol. Forecast. Soc. Chang. 145, 153–164.
Tucker Cross, L., Küller, R., 2004. Environmental atmosphere of outdoor residential areas in southern Sweden: A comparison of experts and residents. J. Architect. Plann. Res. 21 (1), 74–90.
Tucker Cross, L., 2007. Evaluations of Swedish outdoor living environments: Cultural impact of environmental perceptions. J. Architect. Plann. Res. 24 (4), 338–349.
Valderrama Pineda, A.F., Vogel, N., 2014. Transitioning to a Low Carbon Society? The Case of Personal Transportation and Urban Form in Copenhagen: 1947 to the Present. Transfers 4 (2), 4–22.
Vogel, N., 2015. Transition in the Making: A Critical Dispute on Urban Transition Processes towards Sustainable Mobility. Doctoral Dissertation, Aalborg University, Department of Development and Planning; Urban Planning and Mobilities Research Group (UPM) – Aalborg University.
Von Schönfeld, K.C., Bertolini, L., 2017. Urban streets: Epitomes of planning challenges and opportunities at the interface of public space and mobility. Cities 68, 48–55.
Waygood, E.O.D., Friman, M., 2015. Children's travel and incidental community connections. Travel Behav. Soc. 2 (3), 174–181.
World Health Organization Group, 1993. WHOQOL study protocol. WHO (MNH/PSF/93.9).