The changing transport conditions and their implications for pedal cycling in Kisumu, Kenya

Walter Alando*, Joachim Scheiner, Mark Zuidgeest

* Department of Urban & Regional Planning, Maseno University, Private Bag, Maseno, Kenya / Department of Transport Planning, TU Dortmund University, 44227 Dortmund, Germany

Abstract

Current longitudinal studies within transport research have mainly focused on understanding how travel choices respond to changes in events that are within the control of individuals. Little is thus known about the association between travel choices and events that are outside the control of such individuals. The latter events include conditions that are created by the State, which either influence the supply of transport services or the use of the streets for different travel modes. This knowledge gap is particularly pronounced in sub-Saharan African cities, where transport planning is greatly shaped by inconsistent and shifting policies. The current article uses retrospective categorical data obtained from interviews with 2,165 individuals drawn from Kisumu, Kenya to explore the potential of choice modelling to reveal the implications of these policies for transport-related social exclusion. It develops a multinomial logistic regression model to innovatively account for the lag effect of the changing transport conditions on mode choices at three important dates in the history of transport development in Kisumu. These dates are the culmination of the commercialisation of pedal cycling for passenger transport, removal and reintroduction of taxes on pedal bicycles, reforms in public transport, emergence of motorcycle-taxi, and the evolving role of Kisumu as a university city. The results show that the reasons offered by the respondents for their changing travel choices are a response to the conditions that are produced by these State actions. This association however remains invisible to policymakers, leading to a lack of attention to travel modes that are used by the poor. A prominent outcome of the study is the revelation of the re-emergence of private cycling, which remains unsupported in terms of functional allocation of street spaces and policy.

Key words: Motorcycle-taxi; Kisumu; longitudinal analysis; pedal cycling; transport disadvantage; logistic regression

1. Introduction

Longitudinal analysis of travel behaviour holds the potential to unravel useful insights about the changing relationship between mode choices and their drivers (e.g. Chatterjee, Sherwin, & Jain, 2013). Such insights are often hidden from the traditional mode choice analyses because these analyses focus mostly on static relationships at specific points in time. In contrast, longitudinal studies account for the temporal changes in travel behaviour by examining the changes induced by changes in life events and circumstances such as accessibility (e.g. Chatterjee et al., 2013; Jones, Chatterjee, & Gray, 2014). This ability of longitudinal studies to expose the temporal changes is relevant when the policy intention is to initiate life-long behaviour, such as the use of specific travel modes (Jones et al., 2014).

In spite of the above potential, research on changes in mode choices in sub-Saharan African cities is yet to explicitly link changes in travel behaviour with life events in these cities (see e.g. Diaz Olvera, Guézéré, Plat, & Pochet, 2016; Diaz Olvera, Plat, & Pochet, 2013; Pirie, 2012; Sietchiping, Permezel, & Ngomsi, 2012). Moreover, this research seems to pay little attention to the contextual conditions generated by transport-related policies and which mediate various life events in these cities. Consequently, the impact of their rapidly changing transport-related policies on their travel behaviour remains unclear and only implied. This vagueness renders the findings from the current research difficult to use to objectively account for the present changes in modal choices and to understand the possible underlying social exclusion that underlies such choices. The current paper bridges this gap by investigating the situation in Kisumu, Kenya.

Kisumu is a typical medium-sized sub-Saharan African city with about 400,000 inhabitants (GoK, 2010). Its physical size is approximately 297 square kilometres although the urban footprint stretches just about 7 kilometres around its city centre (Nodalis, 2014; UN-HABITAT, 2004). The remaining parts are under agricultural production. Like many other cities of its rank, Kisumu continues to pursue various transport-related policies whose impact on travel choices remain scantily understood (see e.g. GoK, 2007; Sietchiping et al., 2012; Watson, 2014).

* Corresponding author
E-mail address: walter.alando@tu-dortmund.de
The coincidence between transport-related policies and the changing mode choices in Kisumu since 1999 suggests that these policies have impacted both positively and negatively on pedal cycling. This impact is embodied in the shifting mode choices that commuters make in a likely response to the changing transport conditions that are generated by the policies. While some of the policies deliberately targeted cycling (e.g., Institute of Economic Affairs, 2008), unplanned impacts on the mode also spawned from indirect policies. The recent government strategy of increasing access to university education (GoK, 2007) exemplifies such indirect policies. Specifically, this strategy has resulted in increased number of students, whose travel behaviour remains distinct but less understood. Despite the likely connection between various policies and the changing mode choices, structured investigations to unravel this link, its drivers and implications for multimodal transport planning that addresses the needs of different modes remain scanty. Close similarities between the transport situation in Kisumu and its peers make Kisumu an informative case for investigating this link.

The current paper aims to unearth the opportunities and threats that the changing transport conditions present for addressing the policy and infrastructure needs of pedal cycling in medium-sized sub-Saharan African cities. Two specific objectives are pursued: i) to trace the changes in mode choices at key points in the history of transport development in Kisumu, and ii) to explain the drivers of these changes and their implications for addressing the infrastructure and policy needs of pedal cycling.

The findings of this investigation are relevant for both transport research and policy. To the researchers, the paper demonstrates the potential of longitudinal analysis to reveal the tacit factors that produce changes in modes choices following changes in transport-related policies. To the policymakers, these factors constitute the practical concerns that cycling-inclusive transport policy and infrastructure development need to address.

The next section briefly discusses the use of longitudinal data in analysing travel behaviour change. This is followed in section 3 by a presentation of the changing context that is thought to frame the changes in mode choices in Kisumu. The fourth section presents the methodology while section 5 presents and discusses the results. The paper concludes in section 6.

2. Literature review

There is a growing interest in accounting for changes in travel behaviour through longitudinal data analysis. This analysis is argued to improve the understanding of how travel decisions change with time (Schoenduwe, Mueller, Peters, & Lanzendorf, 2015). The inclusion of time dimension of changing travel choices enhances the understanding of both long-term travel decisions such as location choices (e.g., Wegener, 2013; Wegener & Furst, 1999) as well as short-term decisions such as mode and route choices (e.g., Ben-Akiva & Bierlaire, 1999). Despite the relevance of time in understanding the changes in travel decisions, travel behaviour analysis has traditionally remained centred on cross-sectional data. This kind of analysis can only reveal the choices that are made at static points in time but not how the choices change with time (Schoenduwe et al., 2015). This inability to reveal the temporal changes in travel behaviour discounts the potential of travel behaviour analysis to inform life-long policy decisions (Jones et al., 2014). Besides, travel behaviour analysis based on cross-sectional data does not explicitly reveal the reasons that underlie the travel decisions (Jones et al., 2014). Recent developments in longitudinal studies present an effort to address this shortcoming.

Emerging research in the last decade demonstrates the potential of longitudinal studies to bridge the limitations identified above. This research shows that using retrospective data can reveal both the short- and long-term relations between travel behaviour and changes in life events such as residential location and ownership of mobility tools (e.g., Beige & Axhausen, 2008; Jones et al., 2014; Klinger & Lanzendorf, 2016). Beige and Axhausen (2008) for instance show that decisions relating to ownership of mobility tools, the duration for which these tools are kept before they are disposed of and residential movement vary with life events such changes in age, education attainment and employment status of individuals. Through the use of retrospective data, this study shows that people of the same age cohorts exhibit similar travel behaviours over their lifetimes. These revelations are relevant in the context of the previous studies, which have positively related mode ownership and travel distances with the propensity to travel
using these modes (e.g. Wegener, 2013; Wegener & Furst, 1999). In a related analysis of panel data, Scheiner (2014) also reveals that changes in travel behaviour coincide with key life events, such as entry into the labour market, birth of a child in the family, and changes in residential location. These studies reveal changes in travel decisions that would otherwise be hidden from policy processes if investigations did not deliberately focus on analysing the past patterns. Nonetheless, they have visibly centred their attention on the changes in individual circumstances that trigger changes in mobility behaviour.

The above restricted interpretation of life events discounts the potential influence of external events, such as State policies in mediating some of these reported life events. For instance, changes in mode ownership could as well be the result of events that are outside the voluntary control of individual decision-makers. Lanzendorf (2003) categorises life events into \( i \) events which lead to changes in accessibility of places, such as changes in residential places, workplaces, and transport facilities, and \( ii \) events which lead to changes in lifestyle, such as mode ownership, educational and professional attainments. Events which lead to changes in residential places, mode ownership, and transport facilities are arguably triggered by both the individual and the State. Yet current research remains silent on the possible influence of the State. The potential of longitudinal studies to unravel the whole range of circumstances that trigger travel behaviour change is thus discounted.

Some studies on travel behaviour acknowledge the influence of external events identified above (e.g. Beige & Axhausen, 2008; Clark, Chatterjee, Melia, Knies, & Laurie, 2014; Dargay & Vythoulkas, 1999). However, these studies focus on events that are within the control of individuals rather than events outside their control. The closest investigations on the latter events have mainly considered travel behaviour changes that follow disruptions on transport networks (e.g. Ahmad Termida, Susilo, & Franklin, 2016; Fujii, Garling, & Kitamura, 2001; Pnevmatikou, Karlaftis, & Kepaptsoglou, 2015). Little is understood about the influence of external events caused by changes in policies. This deficiency of knowledge is particularly severe in sub-Saharan African cities. This is because the liberty to make independent travel decisions relating to cycling is highly constrained by factors that are outside individual control in these cities. Among these factors are poverty, which generates captive use of particular modes (Lucas, 2011), poor conditions of infrastructure (Trans-African Consortium, 2008), and low car ownership and inadequate public transport (Diaz Olvera et al., 2013). External events that lead to changes in these factors would certainly lead to changes in life events such as mode ownership that predominate the current literature. This relationship together with its drivers however remains obscure.

The current study draws upon the strength of longitudinal studies to investigate the link between historical events in Kisumu and the changing modal share for pedal cycling. Although changes in the share of cycling that follow these historical events have been reported (Maganya, 2008), the underlying drivers of this association remain unclear. This paper questions the possibility that the conditions created by the events could have generated changes in external factors discussed above to produce the observed travel behaviour changes. The next section puts the changing transport conditions in Kisumu into perspective.

3. Changing transport conditions in Kisumu
Many medium-sized sub-Saharan African cities continue to witness travel behaviour changes that coincide with various State interventions that impact on transport (Diaz Olvera et al., 2016; Diaz Olvera et al., 2013; Kopp, 2011; Salon & Gulyani, 2010; Sietchiping et al., 2012). These changes are characterised by a general transition from walking to the use of private cars, quasi-public transport and other intermediate modes such as motorcycles and bicycles. A striking feature of the transition has been the preoccupation of the State with facilitating motorisation while ironically paying vague attention to various forms of non-motorised modes that are used mostly by the poorest (Gwilliam, 2003; Watson, 2014). Neoliberal thinking which emphasises modern technology and a shift from the traditional forms of consumption explains this irony (Hobson, 1999; Watson, 2009). The goals of this neoliberal thinking have been argued to be inconsistent with the social development needs of many sub-Saharan African cities (Musandu-Nyamayaro, 2008; Watson, 2009, 2014). Consequently, various development strategies founded on this neoliberal agenda (e.g. GoK, 2003a, 2007) have generated outcomes that seem to run against the
objectives of inclusive transport. It therefore raises curiosity to find out how these strategies impact on the travel choices of the poor as well as the implication of this impact for their transport inclusion.

In Kisumu in particular, the late 1990s heralded a transition from predominantly private to a mix of public and private means of travelling. Walking and cycling were the main means of private travelling prior to the onset of this transition. Limited ‘public transport’ was also provided by privately-operated shared five-seater saloon cars. These comprised of old, mechanically defective vehicles, which were often overloaded, unreliable and operated without any formal regulation (Anyumba, 1995). The transition from these modes can be classified into three broad phases according to their association with pedal cycling: 1) rapid bicycle boom; 2) emergence of motorcycle-taxis as alternatives to pedal cycling; and 3) motorisation and obscure cycling. These phases mark the key turning points in the history of transport in Kisumu.

The first phase commenced in the late 1990s with the commercialisation of pedal cycling for passenger transport service (UN-HABITAT, 2004). This commercialisation was a response to high unemployment that partly resulted from the sustained influx of unskilled labour force in the wake of the city’s collapsing industrial base (e.g. UN-HABITAT, 2004, 2005). This phase is associated with an increase in passenger cycling for commuting and intra-urban connections (ITDG-EA, 2004)

Pro-cycling taxation provisions and indirect transport policy are further associated with larger share of cycling in this phase. First, the removal of all taxes on imported bicycles in the year 2001 (Kenya National Assembly, 2001) is reported to have made bicycles much cheaper, leading to increased cycling (Maganya, 2008). The gains made by cycling were further consolidated by the publication and enforcement of Legal Notice Number 161 of 2003 (GoK, 2003b). This notice amended the Traffic Act of Kenya by introducing measures that sought to improve road safety in the country in general. Relevant among the measures was the introduction of compulsory seat-belt and speed governors on all public service vehicles.

At the same time, the notice illegalised overloading of public service vehicles. Although these measures did not deliberately target cycling, they nonetheless increased its usage. This was partly because their stringent standards resulted in the collapse of the extant public transport service, thereby creating a gap in transport service. Cycling readily filled this gap while at the same time benefiting from the opportunities created by policies that sought to increase its use.

Support for cycling during the period also emerged from the Sustainable Urban Mobility (SUM) project, which was spearheaded by non-state actors such as the Intermediate Technology Development Group in conjunction with the city authority (see ITDG-EA, 2004). The main objective of the SUM project was to develop a long-term strategy for sustainable transportation and mobility for Kisumu (ITDG-EA, 2004).

Specific target for cycling was to make the mode safe. This target was pursued through advocating for the creation of separate paths for cycling, sensitising drivers on safe road and educating pedal cyclists on road safety. The project was active between 2003 and 2005. However, it did not achieve much, partly due to lack sustained political support from the city authority.

Two developments followed the collapse of public transport that existed prior to the enforcement of Legal Notice Number 161. The current paper presents these developments as the second phase of the history of transport in Kisumu. First was the emergence of 14-seater passenger service vehicles, locally known as matatus, in 2004. Their emergence was arguably a response to the service gap that was created by lack of motorised public transport. The second development was the onset of motorcycling for passenger transport services. This development is of particular interest in this paper because of the popular presentation of motorcycle-taxis as substitutes to pedal cycling (e.g. Diaz Olvera et al., 2016; Kopp, 2011; Sietchiping et al., 2012). In Kisumu in particular, motorcycle-taxis have been popularly presented as socially superior and affordable alternatives for the poor (e.g. Olawo, Ochieng, Ombek, & Achieng, 2014). However, no known research seems to have documented whether this emerging mode is

1 Field notes
2 Constructed from field notes
3 Field interview with practising NMT expert, 20.08.2015
4 ibid
5 ibid
6 ibid
really affordable to its users. Moreover, the importance attached to social appeal as the basis for transport planning is also questionable.

The above argument that motorcycle-taxis offer superior and pro-poor travel option has been used by the State to justify its inattention to cycling. In 2008 for instance, the government removed all import tax on motorcycles of engine capacities below 250cc in order to ‘...encourage motorcycle transport as a superior mode of transport to bicycles as well as (to) create employment opportunities for the youth’ (Institute of Economic Affairs, 2008, p. 18). Such attitudes towards pedal cycling raise doubts about the commitment of the State to enabling cycling in cities like Kisumu where the mode plays a central accessibility-enabling role to its majority captive users. It appears that the commercial interest of the operators, rather than supporting accessibility needs of these users, was the dominant consideration in removing these taxes. It is not surprising therefore that the government subsequently reintroduced import taxes on pedal bicycles in 2007 (Maganya, 2008). This tax increased the retail price of bicycles by half (Maganya, 2008).

The third and last phase is that of growing motorisation and invisible cycling. This phase is characterised by a drop in the amount of pedal bicycle taxis and a re-emergence of private pedal cycling. This reversal happens alongside walking and a growing use of matatus, motorcycle-taxis, and rickshaws. The current re-emergence of private cycling parallels an evolving status of Kisumu as a university city since 2009. Over ten university campuses have been established in the city over this period. A growing number of their students prefer to commute by bicycles.7 Unlike motorisation which is supported by both policy (see Kisumu County Government, 2013; Nodalis, 2014) and ongoing transport infrastructure projects (see World Bank, 2012), similar support for cycling remains unclear.

Table 3-1 summarises the above transition in the development of transport in Kisumu.

<table>
<thead>
<tr>
<th>Table 3-1: Summary of the changing transport situation in Kisumu</th>
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<tbody>
<tr>
<td>- Emergence of commercialised pedal cycling</td>
</tr>
<tr>
<td>- Removal of taxes on pedal bicycles</td>
</tr>
<tr>
<td>- Transport sector reforms</td>
</tr>
<tr>
<td>- Sustainable urban mobility project</td>
</tr>
</tbody>
</table>

The next section presents the procedures that were followed to investigate if these historical developments provided a context for various changes in travel behaviour.

4. Methodology

4.1. Sampling

Data was obtained through standardised interviews that targeted respondents of 2,360 households that resided within the urban footprint of Kisumu. The study adopted the boundaries of the old city, its slum-belt and the peri-urban areas to subdivide this footprint into three broad homogeneous zones that permitted data collection. Previous studies have reported that households from these zones are almost homogeneous in terms of their socio-economic compositions (e.g. Anyumba, 1995; Maoulidi, 2012; UN-HABITAT, 2005). The three zones were further divided into 83 sub-zones to form the sample frame for the selection of sub-zones that contained the respondents.

 Fifty-nine sub-zones were drawn randomly from the above 83 sub-zones in order to allow a systematic random sampling of households whose members participated in the survey. A random starting point was chosen from a random street within each of the 59 zones. The study then interviewed members of the first household on that street and subsequently every fifth household until the required sample size of 40 households per unit was achieved. These interviews were conducted after obtaining consent for participation from the respondents. The respondents were generally willing to participate, either immediately or at appointed times. Nonetheless, the study could not obtain data from members of 292 households who did not cooperate during the survey. Additionally, members of 578 households that were sampled could not be found at home even after revisits.

7 Field interview with practising NMT expert, 20.08.2015
4.2. Data

A retrospective survey was conducted to obtain data on travel choices. This kind of survey has been shown to offer favourable alternatives to panel surveys (Miller & Cottrill, 2013). The latter would have been ideal but were not available in Kisumu. A major limitation of retrospective survey that the study had to address stemmed from the inability of respondents to accurately recall past events (Beige & Axhausen, 2008; Miller & Cottrill, 2013). To deal with this challenge, the study identified the major historical events that coincided with the relevant dates that it investigated. Respondents were then asked to state the changes they made at the time when these events occurred. The intention in doing this was to improve their recall capacities (Beige & Axhausen, 2008).

Household members who were at least ten years of age at any of the turning points were considered competent to participate in the survey. Background information about the households, such as residential mobility, was first obtained from the household heads or their knowledgeable partners. Data on travel behaviour was then obtained from household members who made independent travel decisions. Respondents were asked to state their places of primary occupation in 1999, 2004, 2009 and 2014 and the primary travel modes they used to these destinations. Changes that took place in these elements of travel behaviours before the turning points were probed and recorded. The study was particularly interested in the changes that occurred in years 2004, 2009 and 2014. This is because it deemed these dates suitable for examining the lagged effects of various government interventions on travel behaviour (Section 3).

The travel decisions made in the year that immediately preceded the turning points were taken as the reference for the analysis of the changes. Thus the travel decisions as at the year 2003 were the reference for the changes that occurred in 2004. Similarly, the decisions as at the years 2008 and 2013 were the reference for the changes that happened in 2009 and 2014 respectively.

Changes in mode choices between the reference year and the corresponding turning points were noted and the respondents asked to account for them. Only the main driver of change was recorded in each case. Generally, the respondents tended to consistently use the same main modes over the years. However, some 64, 71, and 18 respondents changed their main mode before 2004, 2009 and 2014 respectively. In this case, the analysis only considered the reason for the change at the turning point. Six directions of change emerged from the investigation. These included changes ‘from cycling to other modes’, ‘from other modes into cycling’, ‘no change from cycling’, and ‘never cycled’. In addition, ‘new entry into non-cycling’ and ‘new entry into cycling’ were also reported. The latter two did not reflect change in its strict sense; they were rather the initial choices that respondents made after settling in Kisumu or attaining the age of ten.

The data analysed in the current study was obtained from 2,165 respondents drawn from 1,490 households. Respondents of age 25 to 30 years formed the majority (29.8%) although those between 19 to 24 years were also significantly many (21.4%). Over 64% of the latter came to Kisumu after the year 2008. It is expected that their travel patterns would be visible in the results of the analysis. About 2,039 respondents were above the age of 19 years, meaning that they qualified to give details of their travel behaviour in 2004 if they lived in Kisumu. The monthly average household income ranged between Ksh. 7,400 and over Ksh. 248,000 with a mode of Ksh. 7,400. This implies that the majority of the respondents came from poor households. These socio-economic characteristics of the respondents identify with the situation in Kisumu (Nodalis, 2014). Data obtained from these respondents related to their mode choices at the reference years, choices at the turning points, derived change in mode choices and the reasons for the revealed changes.

4.3. Data analysis

The objective of the analysis was to trace the changes in mode choices at the key historical dates and explain the drivers of these choices. The number of respondents who arrived in Kisumu in different years was first cumulated till the year that preceded each turning point (P in Tables 4-1a-c). The aim was to obtain the total size of respondents whose changing travel decisions at the turning points were to be examined. The tables show that there were 492 such respondents in 2003 and a further 1,009 and 2,096 respondents in 2009 and 2014 respectively. In addition, there were other respondents who were only

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*US$ 1 = Ksh. 84 at the time of survey*
eligible to participate in the survey after they attained the age of ten years. The choices of these respondents, together with those of the respondents who joined Kisumu at the turning points, were considered as ‘new entry into cycling’ or ‘new entry into non-cycling.’ These choices are collectively referred to as new respondents (N). They comprise 154 respondents in 2004 and a further 329 and 69 respondents in the years 2009 and 2014 respectively.

The share of each mode in the base years and the turning points was then calculated by obtaining the percentage of the proportion of respondents who used the modes. Changes in mode choices were subsequently analysed by comparing the percentage share of each mode at every turning point against its corresponding share in the base year. Results are presented in Section 5.1.

The influence of the drivers of change was predicted using a multinomial logistic regression model. This is a generalised logistic regression that is used when the dependent variable is nominal and takes more than two possibilities (Hosmer, Lemeshow, & Sturdivant, 2013). It estimates the conditional probability associated with each dependent variable (Y) given a collection of p independent variables denoted by vector x’ = (x₁, x₂,...,xₚ). This probability is shown in the model by the estimated parameter (βᵢ), which takes the range β₁, β₂,..., βₚ that correspond with the members of the vector x’.

The model works by estimating the k-1 log-odds of each possibility. For instance, in the current case, one possible set of changes would be ‘not changed from cycling’, ‘change into cycling’, and ‘new entry into cycling’. If these changes are coded as 0, 1, and 2 respectively, and say ‘not changed from cycling’ is taken as the reference, the probability of each dependent variable would be estimated as follows (Hosmer et al., 2013):

\[
P(Y = 0 \mid x) = \frac{1}{1 + e^{g_1(x)}} \tag{1}
\]

\[
P(Y = 1 \mid x) = \frac{e^{g_1(x)}}{1 + e^{g_1(x)}} \tag{2}
\]

\[
P(Y = 2 \mid x) = \frac{e^{g_2(x)}}{1 + e^{g_2(x)}} \tag{3}
\]

where:

\[
g_1(x) = \ln \left[ \frac{P(Y=1 \mid x)}{P(Y=0 \mid x)} \right] = \beta_{10} + \beta_{11}x_1 + \beta_{12}x_2 + \cdots + \beta_{1p}x_p \tag{4}
\]

and:

\[
g_2(x) = \ln \left[ \frac{P(Y=2 \mid x)}{P(Y=0 \mid x)} \right] = \beta_{20} + \beta_{21}x_1 + \beta_{22}x_2 + \cdots + \beta_{2p}x_p \tag{5}
\]

The changes in mode choices at each turning point were modelled as the dependent variables. These changes were derived by classifying the nominal difference between the mode at the turning point and the mode in the base year into the appropriate direction of change (Section 4.2). The corresponding reason for the changing mode choice was modelled as the predictor. Some predictors were revealed to be minor as they predicted only specific changes at some turning points. Where necessary, such minor predictors were collapsed into common categories in order to avoid having zero frequencies in the changes that they could not separately predict. The aim of doing this was to enhance their predictive strength (Tabachnick & Fidell, 2007). For instance, the use of bicycles because destinations were too far to walk or because destinations were located within distances that allowed cycling from the residential location was collapsed into ‘location within cycleable distance’. Similarly, lack of riding skills, unfavourable weather conditions and slow speed of cycling were merged into ‘others’. Ability to cycle, route flexibility, and susceptibility of

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### Table 4-1: Distribution of respondents whose changing choices are analysed in 2004, 2009 and 2014

<table>
<thead>
<tr>
<th></th>
<th>2000</th>
<th>2001</th>
<th>2002</th>
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<tbody>
<tr>
<td>P*</td>
<td>321</td>
<td>376</td>
<td>419</td>
<td>447</td>
<td>492</td>
</tr>
<tr>
<td>N*</td>
<td>56</td>
<td>69</td>
<td>72</td>
<td>74</td>
<td>154</td>
</tr>
<tr>
<td>T*</td>
<td>377</td>
<td>445</td>
<td>491</td>
<td>521</td>
<td>646</td>
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<tr>
<th></th>
<th>2009</th>
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<th>2012</th>
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<tr>
<td>P*</td>
<td>1338</td>
<td>1607</td>
<td>1733</td>
<td>1958</td>
<td>2096</td>
<td>2096</td>
</tr>
<tr>
<td>N*</td>
<td>2</td>
<td>4</td>
<td>4</td>
<td>6</td>
<td>7</td>
<td>69</td>
</tr>
<tr>
<td>T*</td>
<td>1340</td>
<td>1611</td>
<td>1759</td>
<td>1964</td>
<td>2103</td>
<td>2165</td>
</tr>
</tbody>
</table>

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*P = cumulative number of respondents arriving at different years that preceed the turning point, N = New respondents (either eligible for the first time or moving to Kisumu for the first time), T = total number of respondents who took part in the survey.
motorcycle-taxis to fatal accidents were merged into ‘others’ in 2004. The ability to cycle was however dropped from ‘others’ in 2014 because it could adequately predict change on its own.

The model was implemented in SPSS. It works in a twin procedure that first classifies the cycling-related changes before identifying their predictors. These changes either supported or negated cycling. Changes that supported cycling involved ‘(transition) from other modes to cycling’, ‘new entry into cycling’, and ‘not changed from cycling’ (Table 5-2). In contrast, changes that negated cycling involved ‘(transition) from cycling to other modes’, ‘new entry into non-cycling’, and ‘never cycled’ (Table 5-3). Changes that supported cycling were evaluated with reference to the number of respondents that did ‘not change from cycling’. This reference was deemed the best account for engaging in cycling and thus the ideal basis for assessing why respondents favoured cycling. Likewise, changes that negated cycling were evaluated with reference to the number of respondents who ‘never cycled’. In this case, ‘never cycled’ was deemed to offer the best reference for evaluating the reasons for not engaging in cycling. These changes are interpreted using the intercept of the multinomial logistic regression.

The predictors of the above changes are the conditions that were thought to emerge from the changing context of transport in Kisumu (Section 3). This paper views these predictors as the verifiable indicators of direct and indirect State actions that are embodied in the changing historical contexts. Predictors of changes that favoured cycling were evaluated against affordability while those that negated cycling were evaluated against lack of access to bicycles. The choice of these references was informed by the need to clarify their relative influence in producing changes in mode choices. Previous studies (e.g. Alando & Scheiner, 2016; Mutiso, 2010; UN-HABITAT, 2004) have identified affordability and lack of access to bicycles as the key motivator and disincentive to cycling respectively. However, these studies have not shown how these factors relate with other factors that inspire or hinder cycling. The reasons for the changing mode choices are interpreted using the parameter estimate, B. Section 5.2 presents the results of this analysis.

5. Results and discussion

5.1. Tracing the changing modal share

Table 5-1 presents the changing share of different modes at each of the key turning points. The ‘total share before change’ is the percentage share of each mode before change. This share is redistributed into various modes after change as shown in the rows. Resulting modal share is presented in the columns as total share in each turning point.

### Table 5-1: Changes in modal share between the base years and the turning points

<table>
<thead>
<tr>
<th></th>
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<tbody>
<tr>
<td>Walking</td>
<td>58.1</td>
<td>31.6</td>
<td>57.3</td>
</tr>
<tr>
<td>Bicycle (self)</td>
<td>7.3</td>
<td>27.6</td>
<td>27.4</td>
</tr>
<tr>
<td>Bicycle (operator)</td>
<td>27.2</td>
<td>17.1</td>
<td>2.9</td>
</tr>
<tr>
<td>Motorcycle-taxis</td>
<td>0.4</td>
<td>6.9</td>
<td>3.3</td>
</tr>
<tr>
<td>Private cars etc.</td>
<td>16.9</td>
<td>41.7</td>
<td>9.1</td>
</tr>
<tr>
<td>Newcomers</td>
<td>19.3</td>
<td>421</td>
<td>23.9</td>
</tr>
<tr>
<td>Total share before change (%)</td>
<td>50.0</td>
<td>12.1</td>
<td>21.0</td>
</tr>
<tr>
<td>Actual size</td>
<td>246</td>
<td>421</td>
<td>518</td>
</tr>
</tbody>
</table>

**Declining share of non-motorised modes amid growing motorisation**

The findings reveal that Kisumu remains predominantly a walking and cycling city throughout the period of analysis. However, the share of non-motorised transport modes dropped from 91% just before the
year 2004 to 67% in 2014. Walking and private cycling are shown to contribute the most to this decline. Their resulting modal share at the turning points suggests that their general drop is the outcome of a growing competition posed by private and public motorised modes especially before the year 2009. The drop in the share of passenger cycling coincides with the declining availability of bicycle taxis as their operators switch to motorcycle-taxis.\(^9\) We discuss the challenges of this change to cycling in Section 5.3. The share of walking has also decreased as pedestrians switch to other modes, first into passenger cycling in 2004 but later into private cycling. The share of non-motorised modes contrasts with the combined share of private cars, \textit{matatus} and rickshaws, which stood at only 9% at the beginning of the period and rose to 21% by 2014. The share of non-motorised modes still surpassed that of motorcycle-taxis, although the latter had grown rapidly since its emergence in 2004. The shares of cycling and walking should however be interpreted cautiously because no clear-cut definition of pedestrians or cyclists could be obtained from the respondents. This vagueness emerged from 436 respondents who alternated between walking and (private and passenger) cycling as the main travel mode. Since they cycled for at least 2 weeks in a month, they were classified as cyclists because they were deemed to possess useful information that could help in understanding the cycling-related changes.

\textit{Re-emergence of private cycling}

A striking development in 2009 was the reversal of the share of private cycling with that of passenger cycling. This reversal culminated in a dominant share of private cycling and a diminished share of passenger cycling by 2014. Increased private cycling compensates for the declining share of passenger cycling to sustain the identity of Kisumu as a cycling city.

The findings also reveal the resilience of cycling amidst increasing motorisation discussed above. Generally, the share of all motorised modes combined increased by about 24% over the period (Table 5-1). This transition into motorisation is to be expected as the city grows in size, functions and complexity (e.g. Hook & Replogle, 1996; Poudenx, 2008). It is therefore striking that private cycling is evolving to defy this expected pattern. The share of private cycling would still be about 22% in 2014 if it was to be assumed that all the 349 private cyclists who did not cycle daily were instead pedestrians. This persistence of private cycling raises curiosity about what drives people into cycling and the policy implications of these drivers. We explore these in Section 5.3. At the same time, it suggests the likely exclusion that active pedal cyclists continue to face as a result of the current neglect of pedal cycling by the State.

The emergence of motorcycle-taxis raises even more curiosity about the inclusion of pedal cyclists in Kisumu. This is especially so if one considers the amount of State support that motorcycle-taxis have continued to receive, often at the expense of pedal cycling (e.g. Alal, 2014; Alando & Scheiner, 2016; Institute of Economic Affairs, 2008; Municipal Council of Kisumu, 2009). The share of motorcycle-taxis now surpasses that of passenger pedal cycling and is expected to continue doing so unless passenger cycling is deliberately made attractive.\(^10\)

\textit{Tactic association between State policies and travel behaviour}

The above changes in modal shares point to the underlying influence of the historical events highlighted in Section 3. Increased share of passenger cycling in 2004 could be explained by events such as pro-cycling policies and campaigns that preceded the year. This rise in passenger cycling was accompanied by a shrinking share of walking. At the same time, the share of private cars, \textit{matatus} and rickshaws also increased in 2004. The year also heralded the use of motorcycles for public transport. Increased share of private cars, \textit{matatus} and rickshaws associates with the ban imposed by the Legal Notice Number 161. Interestingly, the share of private cycling almost remained stable with only a slight drop from 10.8% to 10.1% during the year. A possible explanation to this trend could be the low fares charged by passenger bicycles operators, which made it affordable for a majority to cycle without necessarily having to ride themselves.\(^11\)

\(^9\) Field interview with Practising NMT expert, 20.08.2015  
\(^10\) \textit{ibid}  
\(^11\) Field notes
The patterns witnessed in 2004 are further sustained into 2008 and 2013 just before the second and third turning points respectively. The end of pro-cycling interventions and the consequent growth of matatus and motorcycle-taxis associate with a drop in the share of passenger cycling. The latter dropped from 32% in 2008 to only 16% in 2009. In contrast, the share of private cars, matatus and rickshaws increased by 6% while that of motorcycle-taxis increased by 7%. The year 2009 concurrently witnessed a drop in the share of walking from 42% to 24%. The changes in mode choices point to the tension between the traveling for faster and affordable transport service on the one hand and what the market forces are willing to supply on the other. Evidently, the historical events between 2004 and 2009 did not create conducive conditions for passenger cycling. This, combined with policies that stifled pedal cycling in the city centre\textsuperscript{12} (also Municipal Council of Kisumu, 2009) prompted an easy shift from cycling when motorcycle-taxis emerged. Private cycling is thus arguably a response to the search for affordable yet faster options and a reaction to government policies that suppress passenger cycling (Alando & Scheiner, 2016; Maganya, 2008; Nodalis, 2014). All forms of non-motorised modes apart from private cycling continued on a declining trend after 2009. In contrast, the share of all motorised modes increased.

The next section contextualises the above results to cycling. It also outlines a basis for examining the drivers of changes in mode choices in each of the three turning points.

\textbf{5.2. Putting the changing mode choices within the context of cycling}

Table 5-2 and Table 5-3 present the results of the multinomial logistic regression analysis. The tables include the model fitting statistics for each turning point. These statistics show whether the inclusion of the predictors improves the prediction of the changes in mode choices when compared to the intercepts on their own. A significant likelihood ratio statistics was obtained for all the final models. This indicates that the models were better with the predictors included than with the intercepts only. The pseudo R-Square statistic (Nagelkerke) is also reported. It is a pointer to the proportion of the variance explained by the model. However, it should be interpreted cautiously in a multinomial logistic regression, because no linear relationship exists between the dependent and predictor variables. Finally, the actual number of respondents (N) at each turning point is also given.

\begin{table}[h]
\centering
\caption{Changes that favour cycling}
\begin{tabular}{l|c|c|c|c|c|c}
\hline
\textbf{Modal change/reasons for change} & \multicolumn{2}{c|}{2004} & \multicolumn{2}{c|}{2009} & \multicolumn{2}{c}{2014} \\
\hline
\textbf{} & \textbf{B} & \textbf{p-val.} & \textbf{B} & \textbf{p-val.} & \textbf{B} & \textbf{p-val.} \\
\hline
\textbf{From other modes to cycling} & & & & & & \\
Intercept & -2.35 & <0.001 & -1.23 & <0.001 & -2.97 & <0.001 \\
Cycling is faster than walking & 2.65 & <0.001 & 2.82 & <0.001 & 2.94 & <0.001 \\
I now have access to a bicycle & 1.69 & <0.001 & 0.65 & 0.01 & 0.97 & <0.001 \\
I am now able to cycle & - & - & - & - & - & - \\
Location within a cycleable distance & 1.44 & 0.04 & 0.08 & 0.88 & 0.27 & 0.73 \\
Route flexibility and less prone to fatal accidents & - & - & - & - & 0.20 & 0.76 \\
Less prone to fatal accidents compared to motorcycle-taxis & - & - & 0.78 & 0.14 & - & - \\
Increased distance to place of occupation is far to walk & - & - & 2.74 & <0.001 & - & - \\
Others (ability to cycle, route flexibility and susceptibility to fatal accidents) & 0.45 & 0.58 & - & - & - & - \\
\hline
\textbf{New cyclists (making a choice for the first time)} & & & & & & \\
Intercept & -0.30 & 0.20 & 0.88 & <0.001 & -3.73 & <0.001 \\
Cycling is faster than walking & 0.82 & 0.01 & -1.24 & <0.001 & -0.19 & 0.82 \\
Bikes are readily available & 0.84 & 0.01 & -0.45 & 0.01 & 0.48 & 0.30 \\
I am able to cycle & - & - & - & - & 0.84 & 0.44 \\
Location within a cycleable distance & -0.46 & 0.37 & -1.88 & <0.001 & 0.50 & 0.54 \\
Route flexibility and less prone to fatal accidents & - & - & - & - & 0.56 & 0.50 \\
Less prone to fatal accidents compared to motorcycle-taxis & - & - & -0.45 & 0.27 & - & - \\
Distance to place of occupation is far to walk & - & - & 0.82 & 0.29 & - & - \\
Others (ability to cycle, route flexibility and susceptibility to fatal accidents) & -0.29 & 0.51 & - & - & - & - \\
\hline
\textbf{It is affordable compared to other faster alternatives (ref. categ.)} & & & & & & \\
\textbf{a. The reference category is: Not changed from cycling.} & & & & & & \\
\textbf{b. This parameter is set to zero because it is redundant.} & & & & & & \\
\textbf{Model fitting information (-2 Log likelihood): intercept only} & 96.53 & 308.63 & 227.34 & & & \\
\textbf{final} & 41.63 & 52.63 & 43.05 & & & \\
\textbf{Pseudo R-Square (Nagelkerke)} & 0.14 & 0.26 & 0.23 & & & \\
\textbf{N} & 303 & 635 & 1,078 & & & \\
\hline
\end{tabular}
\end{table}

\textsuperscript{12} Field notes
The measures used in interpreting the results are the parameter estimates. These are the estimated multinomial logistic regression coefficients for the model. They are interpreted relative to a reference group. If all other variables in the model are held constant, a unit change in each predictor variable is interpreted to generate a change in the logit of the outcome, relative to the reference group, that equals its parameter estimate. Table 5-2 gives details of the changes that supported cycling while Table 5-3 details the changes that negated it.

Cycling-related changes reflect a positive continuation of past choices tempered with new choices

Generally, choices that supported cycling were driven by respondents who did ‘not change from cycling’. Similarly, choices against cycling were mainly driven by respondents who ‘never cycled’ in the base year and at the turning points. An exception to this general pattern was the year 2009, when choices that supported cycling were mainly driven by ‘new cyclists’. The intercepts of the changes at each turning point clarify these general trends.

Relative to the respondents who ‘never cycled’, those who came to Kisumu in 2004 as ‘new non-cyclists’ were more likely to make choices that negated cycling than those who changed ‘from cycling to other modes’. This means that existing cyclists rarely changed to other modes. Majority of the choices that did not support cycling were therefore made by new respondents who came to Kisumu as non-cyclists. The low likelihood of existing cyclists to change from cycling is further confirmed by the changes that favoured cycling. Results show that respondents who did ‘not change from cycling’ made a stronger contribution to choices that favoured cycling than the respondents who either changed ‘from other modes to cycling’ or ‘new cyclists’. New respondents again emerged second in terms of their association with mode choices that favoured cycling.

The findings show that choices that impacted cycling in 2004 were mainly driven by existing cyclists, existing non-cyclists and new respondents. Changes into cycling or away from it impacted the least on the share of cycling revealed in Section 5.1. These results should not however be interpreted to mean that the changes were insignificant, particularly when the absolute number of respondents who were involved is considered. Slightly over 23% of both forms of cyclists changed to other modes in 2004. Concurrently, almost 31% of the non-cyclists changed into cycling. These percentages are derived from Table 5-1. All choices that favoured cycling in the base year but changed against it in 2004 were identified and calculated as a percentage of the original size that favoured cycling. A similar procedure was followed for choices that negated cycling in the base year but changed in its favour at the turning point.

### Table 5-3: Changes against cycling

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>-2.16</td>
<td>&lt;0.001</td>
<td>-2.34</td>
<td>&lt;0.001</td>
<td>-2.37</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Cycling is no longer safe</td>
<td>0.12</td>
<td>0.83</td>
<td>1.15</td>
<td>0.02</td>
<td>-0.99</td>
<td>0.35</td>
</tr>
<tr>
<td>My place of occupation is now far to cycle</td>
<td>0.99</td>
<td>0.16</td>
<td>1.02</td>
<td>0.09</td>
<td>-0.23</td>
<td>0.70</td>
</tr>
<tr>
<td>Ready availability of mode I shifted to</td>
<td>1.88</td>
<td>&lt;0.001</td>
<td>2.11</td>
<td>&lt;0.001</td>
<td>1.21</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Inappropriate type of bicycle</td>
<td>-</td>
<td>-</td>
<td>2.85</td>
<td>&lt;0.001</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Cycling is not socially appealing</td>
<td>-</td>
<td>-</td>
<td>1.24</td>
<td>0.07</td>
<td>0.53</td>
<td>0.30</td>
</tr>
<tr>
<td>It is easier and less expensive to walk because my daily destination is now far from home</td>
<td>0.26</td>
<td>0.65</td>
<td>1.50</td>
<td>&lt;0.001</td>
<td>-0.01</td>
<td>0.99</td>
</tr>
<tr>
<td>Poor infrastructure</td>
<td>3.01</td>
<td>&lt;0.001</td>
<td>1.84</td>
<td>&lt;0.001</td>
<td>1.27</td>
<td>0.08</td>
</tr>
<tr>
<td>Others (Lack of riding skills, unfavourable weather, slow speed of bicycle)</td>
<td>1.47</td>
<td>0.02</td>
<td>1.34</td>
<td>0.03</td>
<td>0.07</td>
<td>0.89</td>
</tr>
<tr>
<td>I no longer have access to a bike (reference category)</td>
<td>0b</td>
<td></td>
<td>0b</td>
<td></td>
<td>0b</td>
<td></td>
</tr>
<tr>
<td><strong>New non-cyclist (making a choice for the first time)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intercept</td>
<td>-1.12</td>
<td>&lt;0.001</td>
<td>-0.20</td>
<td>0.30</td>
<td>-3.67</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Cycling is not safe</td>
<td>1.91</td>
<td>&lt;0.001</td>
<td>1.13</td>
<td>&lt;0.001</td>
<td>0.57</td>
<td>0.38</td>
</tr>
<tr>
<td>My place of occupation is far to cycle</td>
<td>1.19</td>
<td>0.01</td>
<td>0.03</td>
<td>0.93</td>
<td>-0.32</td>
<td>0.79</td>
</tr>
<tr>
<td>Ready availability of the mode I use</td>
<td>1.52</td>
<td>&lt;0.001</td>
<td>-0.17</td>
<td>0.54</td>
<td>-1.55</td>
<td>0.18</td>
</tr>
<tr>
<td>Inappropriate type of bicycle</td>
<td>-</td>
<td>-</td>
<td>1.49</td>
<td>0.05</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Cycling is not socially appealing</td>
<td>-</td>
<td>-</td>
<td>0.32</td>
<td>0.42</td>
<td>0.58</td>
<td>0.53</td>
</tr>
<tr>
<td>It is easier and less expensive to walk because my daily destination is now far from home</td>
<td>-1.35</td>
<td>0.02</td>
<td>-1.41</td>
<td>&lt;0.001</td>
<td>-0.72</td>
<td>0.43</td>
</tr>
<tr>
<td>Poor infrastructure</td>
<td>4.40</td>
<td>&lt;0.001</td>
<td>2.13</td>
<td>&lt;0.001</td>
<td>3.27</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Others (Lack of riding skills, unfavourable weather, slow speed of bicycle)</td>
<td>2.99</td>
<td>&lt;0.001</td>
<td>1.58</td>
<td>&lt;0.001</td>
<td>1.99</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>I do not have access to a bike (reference category)</td>
<td>0p</td>
<td></td>
<td>0p</td>
<td></td>
<td>0p</td>
<td></td>
</tr>
<tr>
<td><strong>Intercept only</strong></td>
<td>270.77</td>
<td></td>
<td>332.42</td>
<td></td>
<td>170.11</td>
<td></td>
</tr>
<tr>
<td><strong>Model fitting information (-2 Log likelihood):</strong></td>
<td>53.36</td>
<td></td>
<td>77.60</td>
<td></td>
<td>55.68</td>
<td></td>
</tr>
<tr>
<td><strong>N</strong></td>
<td>343</td>
<td></td>
<td>703</td>
<td></td>
<td>1,087</td>
<td></td>
</tr>
</tbody>
</table>

The parameter is set to zero because it is redundant.

### Table 5-4: Changes in retention

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>-2.16</td>
<td>&lt;0.001</td>
<td>-2.34</td>
<td>&lt;0.001</td>
<td>-2.37</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Cycling is no longer safe</td>
<td>0.12</td>
<td>0.83</td>
<td>1.15</td>
<td>0.02</td>
<td>-0.99</td>
<td>0.35</td>
</tr>
<tr>
<td>My place of occupation is now far to cycle</td>
<td>0.99</td>
<td>0.16</td>
<td>1.02</td>
<td>0.09</td>
<td>-0.23</td>
<td>0.70</td>
</tr>
<tr>
<td>Ready availability of mode I shifted to</td>
<td>1.88</td>
<td>&lt;0.001</td>
<td>2.11</td>
<td>&lt;0.001</td>
<td>1.21</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Inappropriate type of bicycle</td>
<td>-</td>
<td>-</td>
<td>2.85</td>
<td>&lt;0.001</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Cycling is not socially appealing</td>
<td>-</td>
<td>-</td>
<td>1.24</td>
<td>0.07</td>
<td>0.53</td>
<td>0.30</td>
</tr>
<tr>
<td>It is easier and less expensive to walk because my daily destination is now far from home</td>
<td>0.26</td>
<td>0.65</td>
<td>1.50</td>
<td>&lt;0.001</td>
<td>-0.01</td>
<td>0.99</td>
</tr>
<tr>
<td>Poor infrastructure</td>
<td>3.01</td>
<td>&lt;0.001</td>
<td>1.84</td>
<td>&lt;0.001</td>
<td>1.27</td>
<td>0.08</td>
</tr>
<tr>
<td>Others (Lack of riding skills, unfavourable weather, slow speed of bicycle)</td>
<td>1.47</td>
<td>0.02</td>
<td>1.34</td>
<td>0.03</td>
<td>0.07</td>
<td>0.89</td>
</tr>
<tr>
<td>I no longer have access to a bike (reference category)</td>
<td>0b</td>
<td></td>
<td>0b</td>
<td></td>
<td>0b</td>
<td></td>
</tr>
<tr>
<td><strong>New non-cyclist (making a choice for the first time)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intercept</td>
<td>-1.12</td>
<td>&lt;0.001</td>
<td>-0.20</td>
<td>0.30</td>
<td>-3.67</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Cycling is not safe</td>
<td>1.91</td>
<td>&lt;0.001</td>
<td>1.13</td>
<td>&lt;0.001</td>
<td>0.57</td>
<td>0.38</td>
</tr>
<tr>
<td>My place of occupation is far to cycle</td>
<td>1.19</td>
<td>0.01</td>
<td>0.03</td>
<td>0.93</td>
<td>-0.32</td>
<td>0.79</td>
</tr>
<tr>
<td>Ready availability of the mode I use</td>
<td>1.52</td>
<td>&lt;0.001</td>
<td>-0.17</td>
<td>0.54</td>
<td>-1.55</td>
<td>0.18</td>
</tr>
<tr>
<td>Inappropriate type of bicycle</td>
<td>-</td>
<td>-</td>
<td>1.49</td>
<td>0.05</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Cycling is not socially appealing</td>
<td>-</td>
<td>-</td>
<td>0.32</td>
<td>0.42</td>
<td>0.58</td>
<td>0.53</td>
</tr>
<tr>
<td>It is easier and less expensive to walk because my daily destination is now far from home</td>
<td>-1.35</td>
<td>0.02</td>
<td>-1.41</td>
<td>&lt;0.001</td>
<td>-0.72</td>
<td>0.43</td>
</tr>
<tr>
<td>Poor infrastructure</td>
<td>4.40</td>
<td>&lt;0.001</td>
<td>2.13</td>
<td>&lt;0.001</td>
<td>3.27</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Others (Lack of riding skills, unfavourable weather, slow speed of bicycle)</td>
<td>2.99</td>
<td>&lt;0.001</td>
<td>1.58</td>
<td>&lt;0.001</td>
<td>1.99</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>I do not have access to a bike (reference category)</td>
<td>0p</td>
<td></td>
<td>0p</td>
<td></td>
<td>0p</td>
<td></td>
</tr>
<tr>
<td><strong>Intercept only</strong></td>
<td>270.77</td>
<td></td>
<td>332.42</td>
<td></td>
<td>170.11</td>
<td></td>
</tr>
<tr>
<td><strong>Model fitting information (-2 Log likelihood):</strong></td>
<td>53.36</td>
<td></td>
<td>77.60</td>
<td></td>
<td>55.68</td>
<td></td>
</tr>
<tr>
<td><strong>N</strong></td>
<td>343</td>
<td></td>
<td>703</td>
<td></td>
<td>1,087</td>
<td></td>
</tr>
</tbody>
</table>

The parameter is set to zero because it is redundant.
The year 2009 witnessed a couple of changes in the choices that impacted cycling. Most notable was the influence of choices made by ‘new cyclists’. These choices emerged to surpass the choices of the extant cyclists who ‘never changed from cycling’ (Table 5-2). The implication of this development was that decisions that favoured cycling were now primarily associated with ‘new cyclists’ rather than existing cyclists who never changed their choices. At the same time, cycling benefited from choices that produced changes from other modes to cycling. These choices generated more cycling in 2009 compared to 2004. The contrast between the stronger intercept (-1.23) yielded by the changes ‘from other modes to cycling’ and the one (-2.35) realised for the same changes in 2004 gives credence to this observation. Pedestrians formed the majority of those who changed to cycling (Table 5-1).

The results presented in Table 5-3 further emphasise the growing influence of new respondents on mode choices made in 2009. Specifically, the new intercept (-.20), which is stronger than -1.12 yielded in 2004 shows that new respondents increasingly made choices that negated cycling although their influence was weaker compared to that of respondents who ‘never cycled’. This contribution of new respondents to negating the use of bicycles is however moderated by their strong entry into cycling in 2009. The results further reveal that fewer existing cyclists changed to other modes in 2009 as compared to 2004. This is evidenced by the weaker intercept obtained for changes ‘from cycling to other modes’ in 2009 (-2.34) relative to that of 2004 (-2.16). The net result of these choices is the persistence of cycling that was alluded to in Section 5.1.

The above changes that took place in 2009 seem to have heralded a new phase of stable mode choices among the respondents. The subsequent decisions that favoured cycling in 2014 were thus predominantly driven by existing cyclists who did not change from cycling while decisions against cycling were driven by respondents who never cycled before. The diminishing influence of the changes “From cycling to other modes” (intercept=-2.37), “New non-cyclists” (intercept=-3.67), “From other modes to cycling” (intercept=-2.97), and “New cyclists” (intercept=-3.73) evidences to this observation. The intercepts of all these changes are conspicuously weaker than they were in 2009.

The next section now accounts for these changes.

5.3. Interweaving the reasons for the changing mode choices and the historical events
This section interweaves the above changes with their historicised drivers in an attempt to find the possible association between the changes in travel choices and the changes in policies.

Presentation of cycling as inferior by the State reinforces its avoidance
The above results reveal a general weak inclination of non-cyclists to switch to cycling and vice versa. In particular, motorists from higher income households hardly changed to cycling while cyclists only changed to motoring when that was the only practical option available (Table 5-3 classified according to the average household income). These results suggest that the official State branding of cycling as an inferior mode (see Institute of Economic Affairs, 2008) reinforces its extant negative social presentation thus leading to its declining use among non-captive cyclists. Although these results are based on the income status at the time of data collection only, they are nonetheless consistent with previous findings (e.g. Pochet & Cusset, 1999). Both findings show that low social status associated with cycling hinders its use among the high-income groups in many sub-Saharan African cities. Furthermore, this inferior status encourages its neglect from policy and infrastructure development (Pendakur, 2005; Sietciping et al., 2012). Although cycling in Kisumu is generally avoided by users of motorised modes, it offers the only combination of faster and affordable means of travelling for the poor. There is hence a need for policy and infrastructure development efforts to proactively tackle the needs of this particular market segment rather than stifle cycling on account of its perceived social inferiority.

Cycling responds positively to supportive policies
The reasons offered for the changing choices point to the positive influence of supportive historical events on cycling. This influence is particularly seen in 2004 when cycling was mainly supported by its ability to attract new respondents while at the same time retaining its existing users. New respondents were more likely to be attracted into cycling because it was readily available (B=84) rather than because it was affordable. This finding suggests that the use of bicycles responded positively to the support it received in the early 2000s. This support included its promotion as a tool for employment creation (UN-HABITAT, 2004), tax exemptions (Kenya National
Assembly, 2001), and its promotion as a mode of transport (TDG-EA, 2004). These developments were evidently instrumental in supporting passenger cycling more than private cycling (Table 5-1). Cycling further seems to have responded positively to incidental policies such as the enforcement of Legal Notice Number 161. It should be recalled that this notice phased out the form of public transport that existed in Kisumu prior to its publication, thus leaving their users without any service apart from walking and cycling. Table 5-2 shows that cycling was in this case attractive to new cyclists ($B=2.65$) and respondents who changed from other modes ($B=2.65$). These respondents considered cycling to be relatively faster than walking. The fact that the speed of bicycles attracted other mode users into cycling suggests that cycling readily filled the void that was created in public transport by the enforcement of Legal Notice Number 161.

Pro-cycling policies must be validated by supportive road infrastructure

The conditions presented in Table 5-3 suggest that pro-cycling policies are inadequate without concurrent infrastructure support. Although cycling received various support prior to 2004, the failure to address these conditions caused a shift from cycling and the avoidance of the mode by new respondents. Relative to lack of access to bicycles, poor infrastructure emerged the leading factor that hindered cycling for both the new non-cyclists ($B=4.40$) and respondents who changed from cycling ($B=3.01$). Poor infrastructure continued to exert a leading influence on new choices that negated cycling ($B=2.13$) in 2009. Similar patterns were revealed for the changes in 2014. These results confirm the challenges posed by the failure of the State to prioritise the production of infrastructure that facilitates cycling (e.g. Alando & Scheiner, 2016; Steyn, 2012). Nonetheless, the influence of infrastructure on dissuading existing cyclists was discounted by ready availability of motorcycle-taxis and changing tastes in 2009. These are discussed later.

The above concerns confirm the contradictory efforts of the State towards cycling in Kisumu and other sub-Saharan African cities (Pendakur, 2005; Trans-African Consortium, 2008). While the State supported cycling in Kisumu through various soft strategies, it did not create the concomitant infrastructure to validate this support. Consequently, lack of safety partly due to unsupportive infrastructure emerged the third leading factor that stifled cycling for the newcomers ($B=1.90$) and also contributed to pushing the existing cyclists into motorised modes in 2004 ($B=1.88$). Lack of infrastructure rendered cycling unsafe for both its active and potential users. It influenced more existing cyclists to shift from cycling than it dissuaded new respondents from cycling.

Other factors that negated cycling included the long distances to destinations and the combined effect of lack of riding skills, unfavourable weather and slow speed of cycling. These reasons could however not be directly related to the historical developments of transport in Kisumu. Nonetheless, they suggested that efforts to promote cycling were incomplete unless they integrated land-use and transport concerns in order to create distances that were within cycling reach. Such efforts could also include imparting riding skills and improving the safety on the streets in order to improve the speed of cycling.

It is striking that the higher temperatures of Kisumu did not play a central role in deterring the use of bicycles. Table 5-3 shows that the influence of climatic conditions on mode choices was only significant when it was analysed together with the influence of other factors which were equally insignificant on their own. The reason for combining these factors is already explained under the methodology. This diminished influence of the climatic conditions was contrary to the logical expectation that such unfavourable conditions would deter cycling (see e.g. Gatersleben & Appleton, 2007; Passafaro et al., 2014). However, these revelations are not surprising. Similar results have been reported in other sub-Saharan African cities (e.g. Howe, 2003; Quashie, 2004). A vivid influence of these factors is suggested when the income levels of the households are controlled. This control shows that the conditions make more respondents from higher income households to abandon cycling or not to enter cycling altogether. Relatively higher coefficients of the weather conditions associated with lack of entry into cycling or its abandonment by respondents from households that earned income higher than Ksh. 38,000 gives evidence for this. These results are however not statistically significant when the respondents are grouped according to the income levels of their households. They nonetheless resonate with those of Nkurunziza, Zuidgeest, Brussel, and van Maarseveen (2012) who reveal that these conditions mainly hinder those who are in the decision stages referred to as ‘pre-contemplation’ and ‘contemplation’ to cycle. The pre-contemplation is the stage
where people consider the feasibility and desirability to engage in a particular mode out of the range of options available to them (Bamberg, Fujii, Friman, & Gärling, 2011). The contemplation stage on the other hand is where they actually choose a particular mode (Bamberg et al., 2011). The results obtained for the influence of the climatic conditions after controlling for income show that cycling is predominantly used by the captive cyclists. Pro-cycling transport policies should therefore proactively focus on creating the minimum infrastructure and traffic conditions that enable them to move with ease using their active travel modes.

The influence of susceptibility to accidents, increased distance to main daily destination, and location within distances that permit cycling were not consistently significant over the years and changes in mode choices. They were hence only reported where doing so enabled comparable changes that were significant to be assessed. Highlighting these predictors in spite of their statistically insignificant effects enabled the study to draw attention to their influence in shaping choices.

The choice to cycle reflects an effort to optimise emerging expenditure on transport

Subsequent developments in cycling in 2009 are arguably a reaction to the growth of motorised transport. In particular, past promotion of motorcycling as a modern alternative to pedal cycling seems to have generated a shift from the operation of pedal bicycle taxis to motorcycle-taxis13. This shift culminated in fewer bicycles for passenger transport. The choices in 2009 thus reflect an effort to optimise transport expenditure on alternative modes. Affordability thus emerged to exert a stronger influence on the decision to cycle when compared to all the other factors that informed the decisions of ‘new cyclists’ (Table 5-2). The findings reveal that new respondents were more likely to cycle as long as it was cheaper than other modes. These results suggest that the emergence and subsequent growth of motorcycle-taxis remained insensitive to transport affordability concerns. Motorisation in general seems to have restricted the supply of affordable modes to only walking and cycling. Under these circumstances, cycling emerged as the mode that could deliver the twin-benefit of affordability and speed. This capability is reflected in the preference of cycling over walking by respondents who changed to cycling from other modes (B=2.82). Like in the case of the new cyclists, increased distances from home to main regular destination further made cycling attractive for existing respondents who changed to cycling (B=2.74). However, the reason was not statistically significant in the case of new cyclists.

The above evidence about the influence of affordability is further confirmed when the income levels of the households from where the respondents were drawn is controlled. Only the income levels in the year 2014 was controlled as there was no data for the previous years. In this case, lack of access to a bicycle and ready availability of the mode shifted to turns out to be the dominant reasons why those in the income bracket below Ksh. 20,000 move out of cycling or do not join the mode. Ready availability of alternative mode in this case signified the ready availability of motorcycles especially in the slum and peri-urban settlements where bicycles were actively used. For the poorer travellers, motorcycling is not necessarily the preferred mode but rather the only available alternative to walking in the absence of bicycles. These results confirm our observation that lack of attention to cycling forces its users to either walk longer distances or spend more of their incomes on meeting the recurrent transport cost.

Effort to optimise transport expenditure is further demonstrated by the tendency of the respondents to relapse to walking whenever the distances permitted. In this case, the fact that walking was easier and less expensive (B=1.50) outweighed the influence of lack of access to a bicycle in negating cycling. Results show that respondents would stick to cycling as long as the distances permitted (B=.08) and only change to other modes if their main daily destination became too far to cycle (B=1.02). These results reinforce our earlier proposal that cycling needs should be addressed because of the role that cycling plays in enabling affordable accessibility.

Support for motorcycling without attention to cycling neglects the travel needs of cyclists

The factors that negated cycling in 2009 indicate the influence of motorcycle-taxis on travel choices. This influence particularly disadvantaged respondents who could only afford cycling and walking. Table 5-3 shows that newcomers were more likely not to cycle because they did not have access to bicycles than because

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13 Field interview with Practising NMT expert, 20.08.2015
alternatives to bicycles were readily available as shown previously. Thus the leading influence of ready availability of alternatives to bicycles on choices that negated cycling ($B=2.11$) reflects a lack of alternatives. This observation suggests that the shift by operators of pedal bicycle taxis to the operation of motorcycle-taxis created a service gap for the demand that was previously met by bicycles. The shift forced their clients to use motorcycle-taxis ($B=2.11$) although a majority of them could hardly afford the fares they charge. It is thus arguable that the growing use of motorcycle-taxis was the product of captivity and lack of alternatives rather than a voluntary choice. It is due to this constrained supply of pedal bicycle taxis that new respondents who chose to walk rather than cycle did so, not because it was easier and less expensive to walk ($B=–1.41$), but because they did not have access to bicycles (reference category). However, the influence of constrained supply of pedal bicycle taxis on changes from cycling was weaker than the influence of the ease and expenses involved in using it ($B=1.50$). That many respondents had their own bicycles by 2009 discounted the influence of access on modal changes among existing respondents.

The transport disadvantage posed by the emergence of motorcycle-taxis and simultaneous reduction in the number of passenger bicycle operators was aggravated in 2014. This disadvantage is evidenced by the increased influence of lack of access to a bicycle in influencing choices against cycling. Specifically, lack of access negated cycling more than safety concerns, distances to main daily destinations, and the comparative advantage offered by walking rather than cycling. Again, lack of access to bicycles had a stronger contribution to inhibiting new entry into cycling than distances to main daily destinations, ready availability of alternative modes, and the comparative advantage offered by walking rather than cycling. These results suggest that motorcycle-taxis have emerged to serve the transport needs of what could arguably be presented as the lower working-class but not necessarily the poor majority. Sustained Government support for motorcycle-taxis at the expense of pedal cycling therefore stifles the supply of a faster mode that is affordable for the poor majority. This comprises the rising student population in Kisumu since the year 2009. The steep rise in private cycling (Table 5-1) is a response the gap created by the diminishing supply of affordable transport in Kisumu.14

The growth of motorcycle-taxis also associated with the traffic safety concerns regarding its use. The influence of these concerns on mode choices emerged for the first time in 2009. Cycling was seen to be less prone to fatal accidents when compared to the use of motorcycle-taxis. The effect of susceptibility of motorcycle-taxis to fatal accidents is however not statistically significant. It is nonetheless deliberately presented here because it puts the genesis of fatal accidents involving the use of motorcycle-taxis into perspective. It should be mentioned that motorcycle-taxis have emerged as a leading cause of fatal accidents in many sub-Saharan African cities in the recent years (Manyara, 2016; Mwangangi et al., 2015; Trans-African Consortium, 2008).

**Change in mode choices is also the result of changing preferences and generational change**

Generational changes and its attendant changes in preferences also impacted mode choices. These effects were particularly evident in the transition from passenger cycling to private cycling in 2009. First, the emergence of *inappropriate type of bicycle*15 as a leading reason for shifts from cycling (Table 5-3) points to the quest by the rising number of private cyclists for bicycles which they could ride easily. By controlling for the age of the respondents, this paper shows that inappropriateness of the type of bicycle increasingly became a concern with age. Significant coefficient statistics of this factor are obtained for different age brackets ($B=22.18$ for those presently in the age bracket 31-40; $B=20.95$ for age bracket 25-30; and $B=1.61$ for age bracket 19-24). The age bracket 41-50 shows even higher coefficient. However, it is not statistically significant. It should be borne in mind that respondents in these age brackets were in the age brackets 26-35, 20-25, and 14-19 respectively in 2009 when they reported this concern. What is notable is the coincidence between the year when the concern about inappropriateness of the type of bicycles is first raised and the transition to private cycling in Kisumu in the same year. It should be mentioned that inappropriateness of the bicycles only became a concern when respondents had to ride themselves rather than rely on passenger bicycles.

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14 Field notes and interview with Practising NMT expert, 20.08.2015
15 Have no gears thus considered hard to cycle
The pursuit of suitable bicycles further explains the simultaneous emergence of ‘inappropriate type of bicycles’ as a leading reason for new choices that negated cycling. Results show that ‘access to bicycles’ attracted respondents into cycling while ‘inappropriate type of (existing) bicycle’ pushed them into private cycling. Changes from cycling and lack of entry due to its inferior social status further confirm the demand for geared bicycles which were seen to be socially superior by private cyclists. These concerns coincide with the rising population of youths who commute by private bicycles to various learning institutions in the city. Inferior social status of cycling could however also be attributed to its negative social representation by the State that we discussed earlier. Although inferior social status of cycling was not statistically significant, it is reported because of its relevance in a city like Kisumu where cycling is associated with low social status of riders.

The above preferences stabilised in 2014. Table 5-2 shows that more people were likely to change to cycling because they had access to bicycles (B=.97), were able to cycle (B=2.38), and because they considered cycling to be faster than walking (B=2.94). This was in addition to affordability of cycling when it was compared to the other faster modes. Interestingly, residential location mattered less for respondents who had lived in Kisumu prior to 2009 (B=.27) as long as cycling was more affordable. However, this effect of location was statistically insignificant. In contrast, residential location was an important factor that attracted new respondents into cycling (B=.50). It should be pointed out that the majority of these new respondents were students. They preferred not to live very far from their institutions because of security concerns in situation where they had to leave the institutions very late in the evening. Moreover, they tended to make more trips back home between the lectures. New entry into cycling was also motivated by access to bicycles (B=.48) and ability to cycle (B=.84). New respondents preferred to cycle because it was affordable rather than because they considered it faster than walking (B=.19).

6. Summary and conclusions
This paper situated the changing mode choices in Kisumu within the historical contexts that condition these choices. The paper demonstrates that analysing travel choices based on longitudinal data holds the potential to uncover the hidden drivers of changes in choices that would otherwise be lost from policy processes. Although no direct cause-effect relationship between State interventions and changes in mode choices can be claimed, the reasons offered for the changing mode choices clearly emanate from these State actions. The paper therefore concludes that State actions mediate changes in travel behaviour. Its findings extend those of previous researches (e.g. Chatterjee et al., 2013) by exposing the contribution of State actions to influencing the changing circumstances that trigger the changes in mode choices. The study reveals that sympathetic policies (see ITDG-EA, 2004; Kenya National Assembly, 2001) that were pursued prior to 2004 created conditions that enabled active cycling. Incidental policies, such as the Legal Notice No. 161, are similarly revealed to have positively impacted cycling. However, these policies are less likely to be successful if they do not create the necessary infrastructure and traffic conditions that support pedal cycling. The ease with which the subsequent emergence of matatus and motorcycle-taxis suppressed cycling, by reducing the number of service providers and rendering cycling unsafe, supports this caveat.

The findings further reveal that State-sanctioned commercialisation of pedal cycling for its contribution to employment creation (Institute of Economic Affairs, 2008) erodes its role as a facilitator of accessibility. Travellers who can only afford pedal cycling are thus rendered most disadvantaged when commercial cycling declines. This group is forced to contend with unaffordable motorised transport. The alternative is to walk or cycle privately on unsafe streets that are not produced for cycling (Alano & Scheiner, 2016; Steyn, 2012). A re-emerging popularity of private cycling that is partly sustained by its use among the growing student population also remains unsupported. This lack of support for cycling is attributable to the extent modernist planning attitudes (e.g. GoK, 2007), which remain indifferent to the felt needs of poor travellers in many sub-Saharan African cities (Watson, 2014). In this regard, the current study concludes that the presentation of motorcycle-taxis as affordable options for the poor (e.g. Olawo et al., 2014) leads to further exclusion of the poor.

Field notes

ibid

ibid.
Specifically, this presentation makes invisible their need to participate in mobility and access to socio-economic opportunities using modes that are affordable to them.

The findings of this study are useful for the formulation of transport policies concerned with transport affordability, positive branding of cycling, safety, and access to bicycles. Other areas of policy concerns include the nexus between cycling and land-use and inclusive street spaces for cycling. The study shows that direct and indirect State actions towards cycling can stifle the mode or create new opportunities for it. Transport policies must therefore take cognizance of these actions with a view to enhancing their positive opportunities while checking the developments that might hinder cycling. Although this study examined the lagged effect of the changes in transport circumstances, it recognises that examining these effects on a yearly basis could greatly improve the detection of other drivers of the observed changes. This calls for regular data collection on mode choices and the drivers of these choices.

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References


