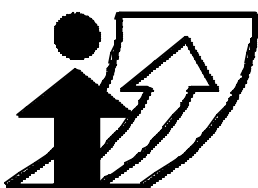


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## **THE INFLUENCE OF KEY EVENTS AND CRITICAL INCIDENTS ON TRANSPORT MODE CHOICE SWITCHING BEHAVIOUR: A DESCRIPTIVE ANALYSIS**

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**Conference paper**  
**Session XXX**



**Moving through nets:**  
**The physical and social dimensions of travel**

10<sup>th</sup> International Conference on Travel Behaviour Research  
Lucerne, 10-15. August 2003

## **THE INFLUENCE OF KEY EVENTS AND CRITICAL INCIDENTS ON TRANSPORT MODE CHOICE SWITCHING BEHAVIOUR: A DESCRIPTIVE ANALYSIS**

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### **Abstract**

This paper presents a first attempt to better understand the influence of key events and critical incidents on transport mode choice switching behaviour. The research problem has been divided into three sub-problems: How do key events and critical incidents affect the composition of choice sets; How do key events and critical incidents influence people's attitude towards available mode alternatives, and How do key events and critical incidents influence people's mode choice behaviour.

In total, 500 questionnaires were distributed using a convenience sample. A total of 196 (representing a response rate of 39%) were returned by mail. The data of 173 respondents were usable for analyses. These 173 respondents reported 309 key events and critical incidents that influenced their mode choice behaviour.

The analyses focus on the most frequently occurring key events: a move from one place to another, first job, change of work situation, getting a drivers license, and getting a car. The effects of these events on choice set composition, attitude, and mode choice were investigated. The study shows that the selected key events result in changes in choice set composition, mode characteristics, attitudes against aspects of mode alternatives, and mode choice.

### **Keywords**

Key events, critical incidents, transport mode choice switching behaviour

### **Preferred citation**

Van der Waerden, Peter, Harry Timmermans and Aloys Borgers (2003) The Influence of Key Events and Critical Incidents on Transport Mode Choice Switching Behaviour: A Descriptive Analysis, paper presented at the 10<sup>th</sup> International Conference on Travel Behaviour Research, Lucerne, August 2003.

# 1. Introduction

Transportation planners are continuously optimising the transportation system. One of the important issues in this context concerns peoples' choice of transport mode. Planners intend to influence peoples' mode choice using a variety of planning measures. The effects of transportation planning measures on mode choice have been investigated in many studies. Some measures like price related measures (e.g. parking costs) seem relatively successful in stimulating people to switch mode while others like flow related measures (e.g. travel time) have less success. For example, Willson (1997) found that commuters started to look for other ways of commuting after the introduction of a parking charge program. As for travel time changes, Dowling and Colman (1995) found that travellers first look for alternative routes and departure times before changing mode.

Transport mode choice is however not only influenced by planning decisions, but also by so-called key events and critical incidents. A **key event** can be defined as a major event in a personal life that will trigger a process of reconsidering current behaviour. For example, when a young person reaches the legal age for a driver's license, he/she will consider to use the car in the future or to continue to use the present transport mode. A **critical incident** is defined as an event that has a major impact on one's attitude such as the involvement in an accident. The incident might affect the present status of the customer relationship (mode choice) in such a way that the process leading to dissolution begins. In contrast to key events, a critical incident is an unexpected or unplanned event.

To our knowledge, little is known in the transportation literature about the impact of key events and critical incidents on transport mode choice switching behaviour, although some studies could be captured in those concepts (i.e., Dowling & Coleman, 1995; Wesemann *et al*, 1996; Bernhoft, 1999; Kingham *et al*, 2001; Lyons *et al* 2002). The study reported in this paper represents a first attempt to better understand this phenomenon in a more quantitative sense. In particular, the purpose of this study is to investigate the relationship between key events, critical incidents and several aspects of mode switching behaviour. The research problem has been divided into the following sub-problems: (i) How do key events and critical incidents influence the number and characteristics of mode alternatives in choice sets, (ii) how do key events and critical incidents influence peoples attitude towards available mode alternatives, and (iii) How do key events and critical incidents influence the choice of transport mode.

To this effect, the remainder of this paper is organized as follows. We first describe the design of the study where we explain the relation between key events and critical incidents, and people's mode choice behaviour by means of a conceptual framework. In section 3, the data collection is explained. Then, we report per sub-problem the major findings. The paper is completed with a discussion of the implications of the findings for traffic management.

## 2. Research design

This study is a continuation of a previous study by Van der Waerden and Timmermans (2003). In that study, a literature search was conducted to identify possible key events and critical incidents that may influence transport mode switching behaviour. A list of more than 90 key events and critical incidents was presented to respondents. Respondents were requested to indicate (i) whether the event or incident was relevant to them personally (did they ever experience it), and (ii) whether the event or incident made them switch to another transport mode. In the study, the influence of the key events and critical incidents was not specified in detail. The most indicated key events and critical incidents were selected from this research and are presented in table 1.

In addition to the study of Van der Waerden and Timmermans (2003), we now investigate the influence of the most indicated key events and critical incidents on the individuals' travel behaviour in more detail. Now, we assume that the selected key events and critical incidents can influence the number and/or the characteristics of transport alternatives and/or the attitude of respondents towards transport alternatives. In addition, a change in alternatives or attitude may influence the choice of transport mode for the next trip (Figure 1). It is also possible that a change in the alternatives changes the attitude towards that alternative. The existence and strength of influence depends on personal characteristics (e.g., age, gender, educational level, ability, and profession) and other characteristics (e.g., infrastructure, traffic system, safety, and weather conditions).

The arrows in the conceptual framework refer to changes in transport mode alternatives, attitude, and mode choice behaviour that will be described in more detail. The description is completed with examples of questions from the questionnaire (Figures 2-5). Respondents were asked to identify one or two key events or critical incidents that influenced their mode choice behaviour most. For each event or incident, respondents were asked to answer questions concerning the influence of the event or incident on choice set composition, change in characteristics of former and current modes, attitude towards former mode and current mode, and mode choice.

## Transport mode alternatives

First, the relation between key events and critical incidents and the set of available transport mode alternatives is investigated. In general, two possible types of changes in transport mode alternatives caused by events and incidents can be distinguished: (a) change in the number of available alternatives and (b) change in characteristics of available alternatives.

### *a. A change in the number of available alternatives*

In the questionnaire, the respondent had to state if the key event or critical incident has influenced the availability of transport mode alternatives (Figure 2). If there was a change in availability the respondent had to state how the composition of the choice set changed. The answer categories were: more alternatives available, less alternatives available, the same number of alternatives available but with different characteristics, and no change in the composition of the choice set.

### *b. A change in the characteristics of available alternatives*

The respondents were asked to state if something changed in the characteristics of the former mode and, if something changed, in the current mode (Figure 3). The former mode refers to the mode that was used before the event or incident while the current mode refers to the mode that is used after the event or incident. Because it is not necessary that the event or incident influence the mode choice, the former mode and current mode can be the same. The following characteristics were investigated: travel time, travel costs, comfort, safety, and reliability. Three answer categories were available: increase, no change, and decrease compared to the situation before the event or incident took place.

## Attitude

Secondly, the relation between key events and critical incidents and the attitude towards mode alternatives is investigated. Respondents were asked to indicate if the key event or critical incident has changed their attitude towards the former mode and current mode (Figure 4).

Three answer categories were available: the event has a positive, negative or no influence on my attitude towards former or current mode. The investigated attitudes were environmental friendly travel, healthy travel, comfortable travel, safe travel, having privacy, suffer from weather conditions, reading during travel, and ease of taking luggage.

## **Mode choice behaviour**

The questionnaire focused on the change in mode choice. Therefore, respondents had to indicate if the event or incident has changed their choice of mode (Figure 5). The following mode alternatives were specified in the questionnaire: car driver, car passenger, bike, train, bus, walking, and other.

## **3. The Data**

In total, 500 questionnaires were distributed using a convenience sample. In total, 196 questionnaires (response rate of 39%) were returned by mail, of which 173 could be used for the analyses. Table 2 presents some characteristics of 165 respondents. Eight respondents did not fill in their personal characteristics. It appears that per characteristic the respondents are distributed across the different characteristic levels according to general expectations.

The 173 respondents named 309 key events and critical incidents that influenced their mode choice behaviour. Table 3 presents the percentages of occurrence for each event/incident. To get a first impression of the effects, the remainder of the analyses in this paper focuses on the most frequently occurring events: a move from one place to another, starting to work (first job), change of work situation, getting a drivers license, and getting a car. The selection only consists of key events. In the remainder of this paper we will focus on these key events.

## 4. Analyses

The analyses are divided into three parts according to the three sub-problems as described in section 1. First, the relationship between the selected key events and the transport mode alternatives is described (subsections a and b). This is followed by a description of the relationship between the selected key events and attitudes (subsection c). The final part contains a discussion of the relationship between the key events and the changes in mode choice (subsection d).

### *a. Key events and number of alternatives in choice set*

A key event can change the composition of the set of available alternatives. Figure 6 presents per key event the reported changes in the composition of the choice set. The figure presents four answer categories: (i) There are more alternatives available; (ii) There are less alternatives available; (iii) The number of alternatives did not change, but the composition of the choice set changed, and (iv) Both the number of alternatives and the composition of the choice set remained the same. The right set of bars ('Overall') presents the overall effect of the five most occurring key events together.

It appears that the selected key events affect the composition of the choice set considerably. In general, the events result in an increase of the number of alternatives in the choice set. As expected, the influence varies by event. The key events 'getting drivers license' and 'getting a car' result mostly into more available alternatives. Only a minority replaces the car by a new one. The influence of the other events on the number of alternatives and the composition of the choice set is much smaller. Despite the low percentages, the effects of the events 'Move', 'Starting to work', and 'Work situation' on the availability of alternatives and composition of choice set are remarkable.

### *b. Key events and characteristics of alternatives*

Some key event can change the characteristics of the former and/or current mode. Figures 7a and 7b show the results of this part of the analyses for the events 'Move', 'Starting to work', and 'Change work situation'. For each characteristic of the transport mode, one sub figure is presented. All sub-figures are divided into two parts, one for former mode and one for current mode. The figures include the situation that former mode is equal to current mode. The left part of the figure presents the effects of the event on the characteristics of the mode the respondent used before the event took place (former mode). The respondent was asked to com-

pare the status of the selected characteristics before and after the key event. The right part of the figure shows the effect of the event on the characteristics of the current mode. Again, the respondent had to compare before and after situation for this specific mode. For example, a move from one place to another results for more than 39 percent of the respondents (who have filled in this event) into an increase of the travel time of the mode they used to use (former mode). For 32 percent of the respondents the travel time of the former mode did not change. The travel time of the former mode decreased for 29 percent of the respondents. In addition, the move changed the travel time for the mode (current mode) the respondents are using after they moved (32 percent increase and 29 decrease). For 39 percent the travel time of the current mode did not change after the move.

From the figures, it can be concluded that mode characteristics time, costs, and comfort are more sensitive for the selected key events than safety and reliability. In the case of 'Time', the events result mainly into a decrease of travel time for both former and current mode. In the case of the former mode the effect of the events is larger than in the case of the current mode. A small exception of this view can be seen in the case of a move. For 'Costs' and 'Comfort', the events result mainly in an increase of the costs level and comfort level. The selected key events have only a minor effect on 'Safety' and 'Reliability' of both former and current mode. An exception to this result is the influence of 'Starting to work' on the reliability of a transport mode. It appears that both Safety and Reliability of former and current mode increase after starting to work.

### *c. Key events and attitude*

The influence of the selected key events on the attitude towards various aspects of mode alternatives is displayed in figures 8a (attitude towards Environmental friendly, Healthy, Comfortable travel, and Safe travel), and 8b (attitude towards Having privacy, Weather conditions, Reading during travel, and Taking luggage). The respondents were asked to compare their attitude towards both former and current mode before and after the key event. The overall view shows that the selected key events do not influence the attitude towards the investigated aspects of both former and current mode seriously. However, there are some exceptions. The aspects 'Comfortable travel', 'Having privacy', 'Suffer from weather conditions' and 'Ease of taking luggage' seem to be more sensitive for the events. For these events, it appears that the key events result in a more positive view of the current mode and more negative view of former mode. This holds especially for the events getting driver's license and getting a car. Also starting to work has some influence. For the remaining aspects, the class 'Unchanged' is dominant.



*d. Key events and mode choice*

A key event might not only result into changes in mode characteristics or attitude towards modes, but can also result into a change of mode choice. Table 4 presents the changes for the selected key events. The table shows per key event the changes from former mode to current mode. For example, a 'move' results into a change from car driver to slow mode (approximately 44 percent of the administered events) or a change from car driver to public transport (approximately 11 percent). It appears that the selected key events mainly result into a change from car passenger, slow mode, and public transport to car driver. In the case of a 'move' and 'starting to work' this effect is less than in case of the other events. When respondents move from one place to one other, slow mode and public transport also become more popular.

## 5. Conclusions

This paper reported findings concerning the effects of key events and critical incidents on various aspects in the context of mode choice switching behaviour. From a set of 16 key events and critical incidents, the most frequently occurring key events or critical incidents were selected for a more detailed analyses: a move from one place to another, starting to work, change in work situation, getting a drivers license, and getting a car. The selection only consists of key events. The effects of these events on choice set composition, attitude, and mode choice were investigated. The study shows that the selected key events result in changes in choice set composition, mode characteristics, attitudes against aspects of mode alternatives, and mode choice. Table 5 presents a summary of our findings.

The results of this study can provide politicians and planners relevant information about the way they can deal with especially key events. For example, the key events 'Getting a drivers license' and 'Getting a car' have a big influence on the composition of choice sets, the attitude towards modes, and the choice of modes. Politicians and planners can give attention to the moment of this kind of events by providing information of alternative modes (slow modes and public transport) or by increasing the costs of car use (e.g., insurance).

In future research, the effects of other critical incidents and key events will be investigated in more detail. Also attention will be paid to other issues like the moment that incidents and events take place and the sustainability of changes caused by incidents and events. Finally, we will try to model the adaptive mode choice behaviour using the personal characteristics of the respondents and the various key events.

## Acknowledgement

The authors want to thank Edgar van Heerde of the International School of Tourism and Transportation in Breda for his contribution to the research.

## 6. Literature

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**Table 1:** Overview of selected key events and critical incidents

	<i>Event/Incident</i>		<i>Event/Incident</i>
1	Marriage	9	Getting a bike*
2	Move	10	Getting a car*
3	Change of school location	11	Getting a ticket for public transport
4	Starting to work	12	Change of working hours
5	Change of work situation	13	Change in health
6	Learn to cycle	14	Transport mode broke down
7	Getting driver's license	15	Invitation for carpooling
8	Getting a moped*	16	Change of weather conditions

\* Including new purchase, trade in and extension

**Table 2:** Overview of personal characteristics of the respondents (N=165)

<i>Characteristic</i>	<i>Levels</i>	<i>Frequency</i>	<i>Percentage</i>
Gender	Male	90	54.5
	Female	75	45.5
Age	Younger than 26	52	31.5
	26 through 45	60	36.4
	Older than 45	53	32.1
Household size	1 person	23	13.9
	2 persons	37	22.4
	3,4,5 or 6 persons	94	57.0
	More than 6 persons	11	6.7
Education	Level 1 (low)	60	36.3
	Level 2	50	30.3
	Level 3 (high)	55	33.4
Hours work	No work	23	13.9
	Less than 21 hours	55	33.3
	More than 21 hours	87	52.7
Drivers license	Yes	151	91.5
	No	14	8.5

**Table 3:** Percentages of occurring key events and critical incidents

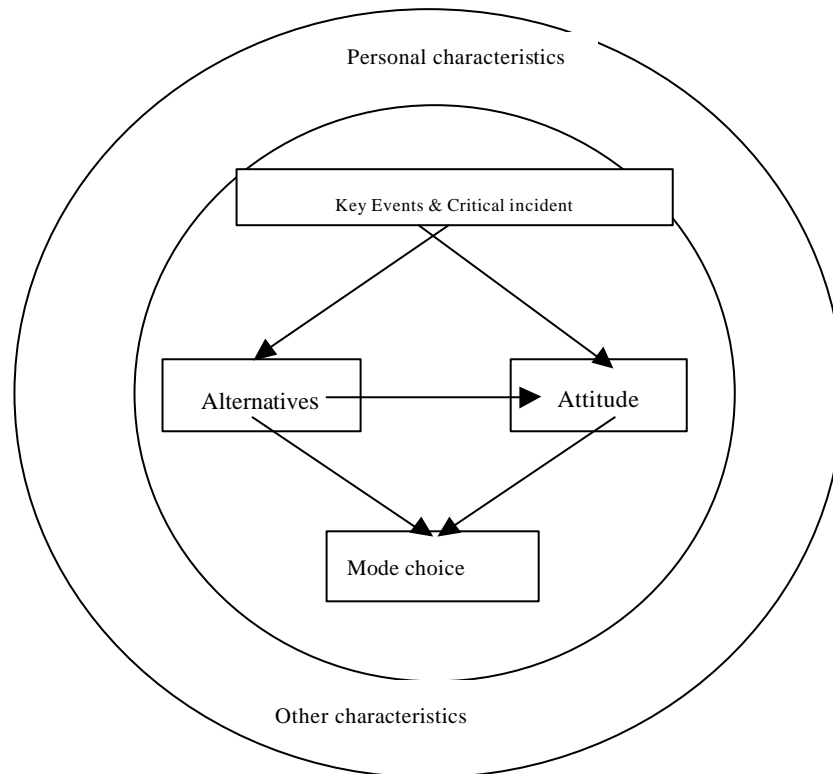
<i>Code</i>	<i>Key events and Critical incidents</i>	<i>Frequency</i>	<i>Percentage</i>
1	Marriage	8	2.6
2	Move	32	10.4
3	Change of school location	24	7.8
4	Starting to work	26	8.4
5	Change of work situation	49	15.9
6	Learn to cycle	8	2.6
7	Getting drivers license	55	17.8
8	Getting a moped*	2	0.6
9	Getting a bike*	4	1.3
10	Getting a car*	46	14.9
11	Getting a ticket for public transport	19	6.1
12	Change of working hours	6	1.9
13	Change in health	4	1.3
14	Transport mode broke down	4	1.3
15	Invitation for carpooling	6	1.9
16	Change of weather conditions	8	2.6
17	Other events or incidents	8	2.6
Total		309	100.0

\* Including new purchase, trade in and extension

**Table 4:** Key events and changes in mode choice

<i>Key Events</i>	Former mode	<i>N</i>	<i>Current mode</i>			
			Car driver	Car passenger	<i>Slow mode</i>	<i>Public transport</i>
Move	Car driver	9	44.4		44.4	11.1
	Car passenger	2	50.0		50.0	
	Slow mode	15	66.7		20.0	13.3
	Public transport	5		40.0	40.0	20.0
Starting to work	Car driver	2	100.0			
	Slow mode	16	56.3	6.3	31.3	6.3
	Public transport	8	50.0	12.5	37.5	
Work situation	Car driver	16	37.5	6.3	43.8	12.5
	Car passenger	7	71.4		14.3	14.3
	Slow mode	18	66.7	11.1		22.2
	Public transport	6	83.3		16.7	
Getting license	Car passenger	8	100.0			
	Slow mode	30	86.7	6.7		6.7
	Public transport	17	94.1		5.9	
Getting car*	Car driver	3	100.0			
	Car passenger	6	100.0			
	Slow mode	21	90.5		9.5	
	Public transport	16	100.0			

\* Including new purchase, trade in and extension



**Figure 1:** Conceptual frame work

<b>Question:</b> Did the reported key event / critical incident change the availability of transport mode alternatives?	
? Yes	? After the event/incident I have more alternatives available ? After the event/incident I have less alternatives available ? After the event/incident I have the same number of alternatives available but the composition changed
? No	? Both the number of alternatives and the composition of available alternatives did not change

**Figure 2:** *Part of the questionnaire concerning changes in availability*



<b>Question:</b> Did the reported key event / critical incident change one of the characteristics of the former transport mode?			
<i>Characteristics</i>	<i>Change</i>		
	<i>Increase</i>	<i>No change</i>	<i>Decrease</i>
Travel time	?	?	?
Travel costs	?	?	?
Comfort	?	?	?
Safety	?	?	?
Reliability	?	?	?

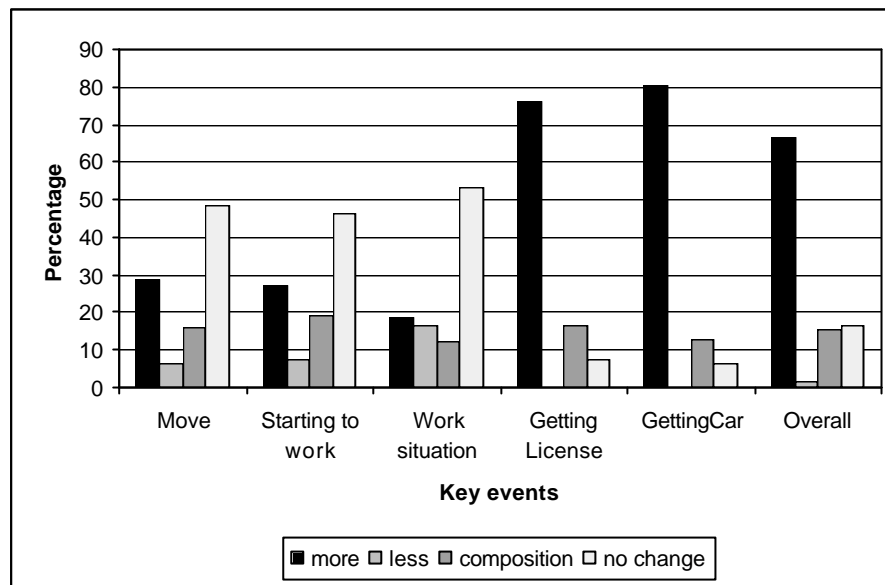
**Figure 3:** Part of the questionnaire concerning changes in characteristics of alternatives

<b>Question:</b> Did the reported key event / critical incident change the attitude towards the former mode?			
<i>Attitude</i>	<i>Influence</i>		
	<i>More Positive</i>	<i>Unchanged</i>	<i>More Negative</i>
Environmental friendly travel	?	?	?
Healthy travel	?	?	?
Comfortable travel	?	?	?
Safe travel	?	?	?
Having privacy	?	?	?
Suffer from weather conditions	?	?	?
Reading during travel	?	?	?
Ease of taking luggage	?	?	?

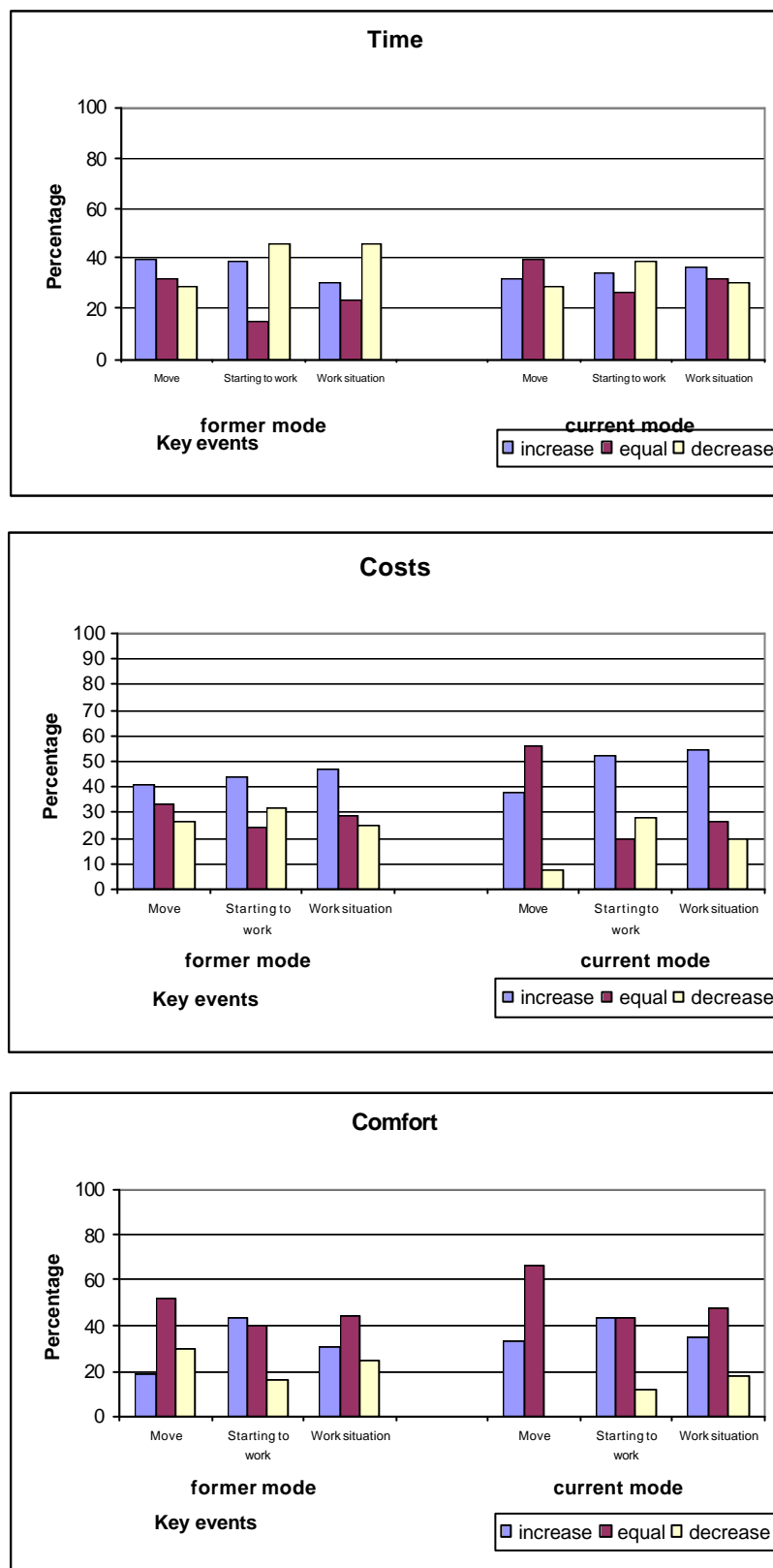
**Figure 4:** Part of the questionnaire concerning changes in attitude towards mode alternatives

<b>Question:</b> <i>What mode did you use before (former) and after (current) the key event or critical incident took place?</i>	
Former mode	Current mode
? No change	
? Change, first I used .....	Now I use .....
? the car as driver	? the car as driver
? the car as passenger	? the car as passenger
? the bike	? the bike
? the train	? the train
? the bus	? the bus
? walking	? walking
? other, namely .....	? other, namely .....

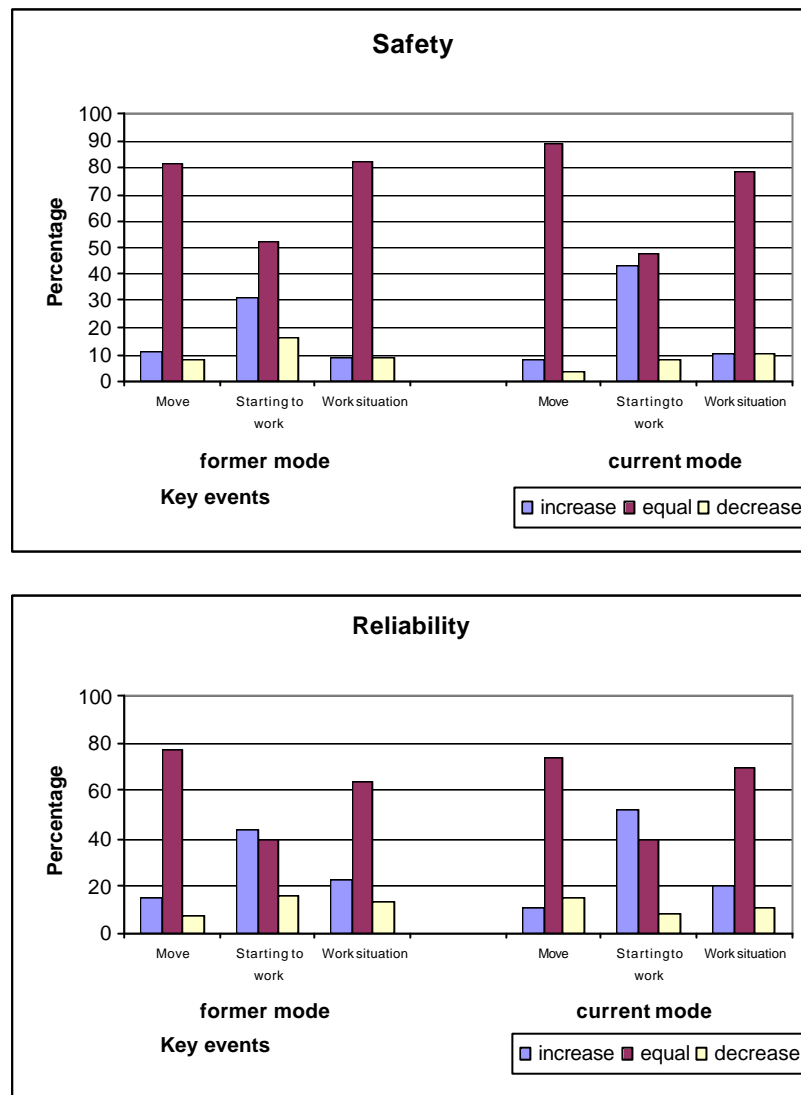
**Figure 5:** *Part of the questionnaire concerning mode switching behaviour*



**Figure 6:** *Change in choice set composition*



**Figure 7a:** *Changes in characteristics of mode alternatives*



**Figure 7b:** *Changes in characteristics of mode alternatives, continue*

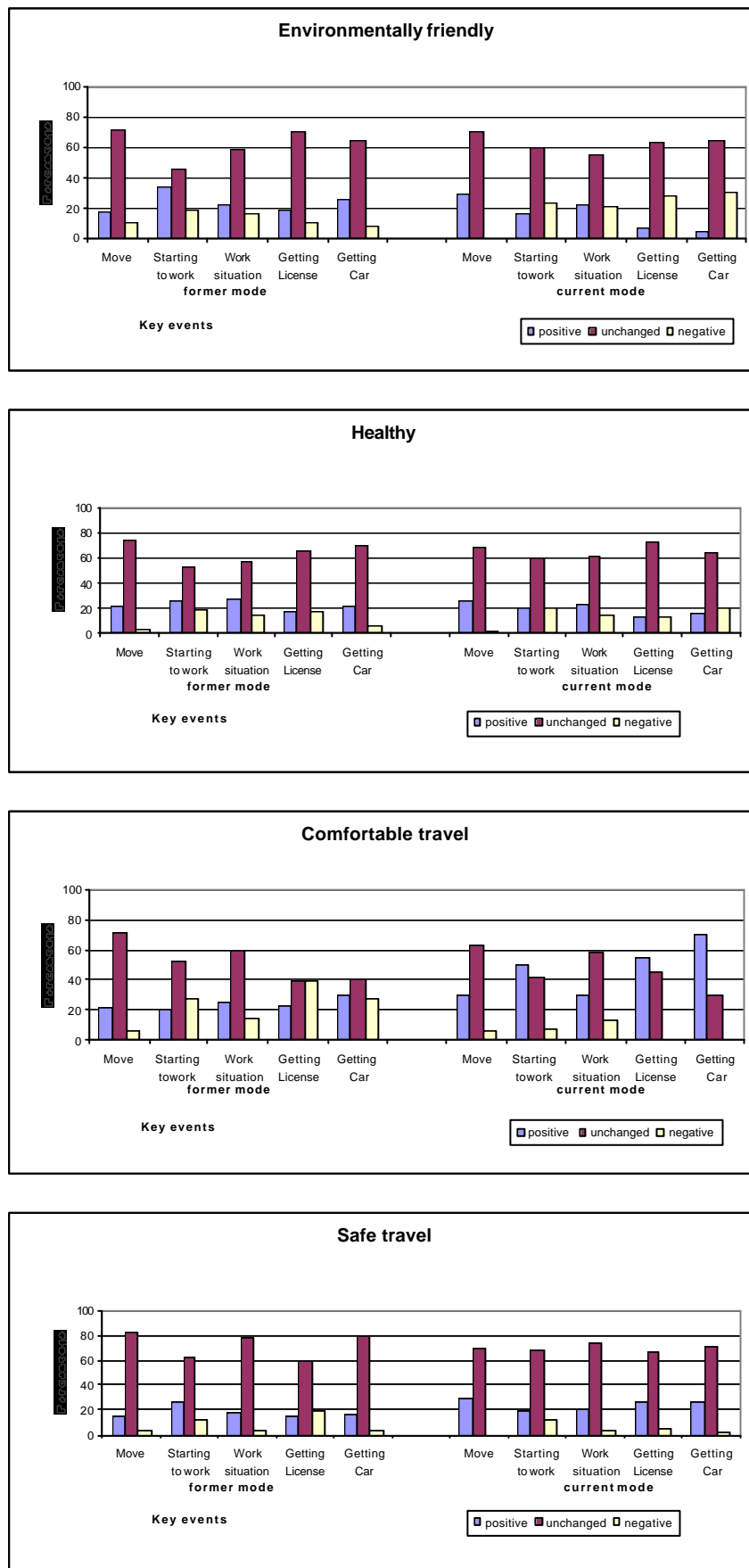


Figure 8a: Changes in attitudes towards mode alternatives

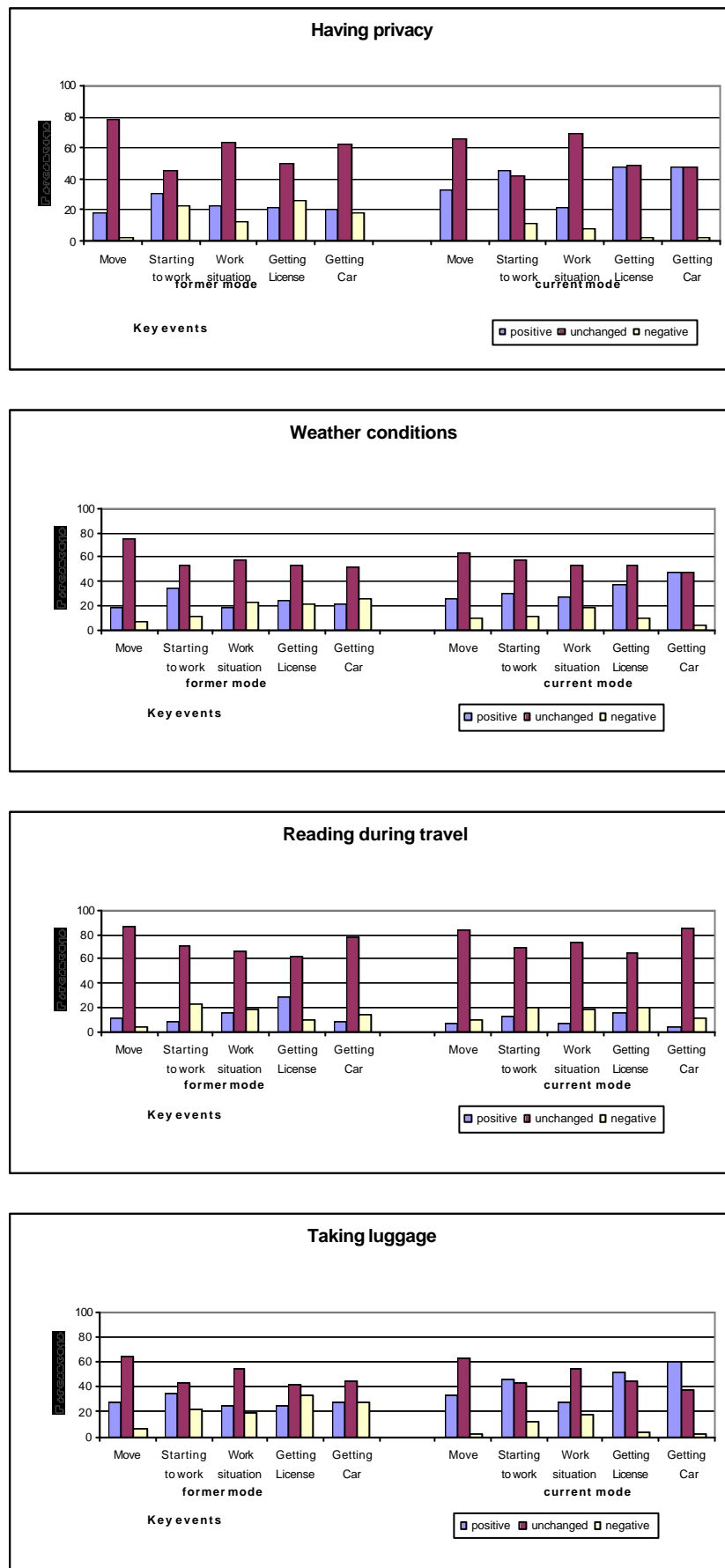


Figure 8b: Changes in attitudes towards mode alternatives, continue