

Considering Habit in Research on Travel Mode Choice: A Literature Review with a Two-Level Methodology

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ABSTRACT: *This study used sources from selected databases to provide an overview of the role of habit in choosing a mode of travel. The articles were selected from two levels. The first included selected studies that considered the psychological aspects of travel mode choice and travel mode change. These created the context for the issues of mode choice and the change of travel mode. The second level was narrower and included studies that were directly focused on the role of habit in travel mode choice or that took the role of habit into account. These studies were used as the core of the review. Subsequently, the topic of habit and travel mode choice was divided into four fields: the theoretical definition of the concept of habit, both in general and in the context of travel mode choice; the theoretical bases of the selected studies; follow-up strategies for transport-mode change; and the measurements and methods used in the field. The Theory of Planned Behaviour (TPB) is the most often used theory for explaining the travel mode choice. Other approaches include the Norm Activation Model and the Value Belief Norm Theory. The aim for other approaches is usually to trigger conscious choice processes, but most researchers believe that travel mode choices are automatic and habitual when made in a stable context. The Comprehensive Action Determination Model is a promising theoretical integration that may be used in future research. It integrates assumptions of the TPB, Norm Activation Model, theoretical habit conception, and ipsative behaviour theory in order to build on habitual processes, intention processes, situation effects, and personal and social norms. As habit seems to have the most important role in the choice of travel modes and the possible changes, it should also be considered for mode-choice models in the automation era.*

KEYWORDS: *Travel mode, Transport mode, Car use, Habit, Theory of planned behaviour, Mode choice.*

1. INTRODUCTION

The concept of sustainable transport is a long-time issue that is widely discussed in several transport fields. Consequently, a wide range of measures and policies have been established over the last two decades to support sustainable travel modes, such as walking, cycling, and public transport. In general, called “no car use” (NCU). To be successful and effective, these policies and measures must consider the field of travel mode choice. This information is made available through social science research that has searched for specific theoretical models to explain the stability and potential changes in travel mode choices. Subsequently, these models have been tested in order to provide leads for successful changes to more environmentally friendly and healthier travel modes. Since travel behaviour is believed to be habitual, most models use habit as the key variable. Habit, in various forms and definitions, is considered the crucial agent that impacts the willingness to keep or to change travel behaviour. Unfortunately, there are few studies that comprehensively describe habit and its role. Therefore, this work aims to make an overview of the role of habit in the process of making travel mode choices. This standpoint includes existing academic studies and considers the concept of habit in travel mode choice in the dichotomy of car use vs. no car use.

2. CONCEPT OF HABIT IN GENERAL AND IN TRAVEL MODE CHOICE STUDIES

Nowadays, habit is perceived to be complex in nature and initial behavioristic conceptions (e.g. Hull,

1943; Watson, 1914) are obsolete. The original ideas of behaviorists were that habits depended upon simple connections between cues and responses without mental representations that are considered important at that moment, including the roles of consciousness, goals, and motivation (e.g. Neal et al., 2006). In the context of social psychology, the concept of habit is often included in models that explain human behaviour. Triandis (1977, 1980) views the probability of the occurrence of certain behaviour as the result of habit and intention that is affected by physiological excitement and objective conditions. The increase of intention is reflected in reduced habit and vice versa, which leads to a balance between intentional and habitual activity. In the context of travel mode choice, habit is included in several verified models, including TPB (Ajzen, 1991), Norm Activation Model (Schwartz, 1977), and Value Belief Norm Theory (Stern, Dietz, Abel, Guagnano, & Kalof, 1999; Stern, 2000).

As Neal, Wood, and Quinn (2006) claim, habits force us to do what we have always done, despite our best intentions to behave differently. Habits are traditionally regarded as learned behaviour that became an automatic reaction to certain circumstances (e.g., Ronis, Yates, & Kirscht, 1989; Triandis, 1980). According to Ouellette and Wood (1998), behaviour that is often exhibited and occurs in a stable or similar context (Neal et al., 2006), reoccurs because the processes that initiate and control the behaviour had become automatic. Strengthening automatic behaviour, which is often exhibited and done in a stable context, has already been documented by Shiffrin and Schneider (1977) in their studies of information processing. When behaviour becomes automatic (i.e., it ceases to be exhibited intentionally) it is commonly regarded as a habit. Therefore, habit can be defined as a disposition to responses that are activated automatically by context keys/cues, which appeared together with these responses (i.e., behaviour) in previous activities (Neal et al., 2006) or which are more simply a learnt disposition to repeat past reactions (e.g., Wood & Neal, 2007). The strength of habit is then expressed by the frequency of a given behaviour in the past. Habitual behaviour represents a significant proportion of ordinary activities. Nearly 45% of ordinary activities tend to be repeated in the same place nearly every day (Neal et al., 2006; Wood, Quinn, & Kashy, 2002). Friedrichsmeier, Matthies, and Klöckner (2013) discussed the theoretical concepts of habit directly in the stability context of travel

mode choice. The researchers consider context stability and past-behaviour frequency to be the main habit components.

However, it is necessary to distinguish habit from past behaviour (Forward, 2014; Lanzini & Khan, 2017; Ouellette & Wood, 1998; Verplanken & Aarts, 1999). Habits are perceived as more complex. Repeated behaviour is just a basic definition. The crucial factors include a stable context and a goal focus. Habits are characterized by the target type of automation (Aarts, Verplanken, & van Knippenberg, 1997). Goal focus distinguishes habits from other forms of automated behaviour, such as body reflexes (Verplanken, Aarts, & van Knippenberg 1997). Goals motivate people to repeat their behaviour and support searching for habit cues. Repetition, thus, supports habit formation (Wood & Neal, 2007). In this context, Neal et al. (2006) emphasize the significance of implicit goals. Implicit goals assume the formation of an indirect relationship between context and response through a wider system of intermediating goals. A habit develops when a certain goal is repeatedly followed through a specific behaviour in a given context. Implicit goals themselves offer strong impulses to action. If there is a goal to act (e.g., a trip to a certain place), the decision for the course of action and the decision on the subsequent performance of the action can be made without special elaboration.

So, the habit, either by itself or in connection with other factors, can be an important factor in travel mode choice. By repeating one type of travel behaviour, the decisions (i.e., what behaviour to choose) become relatively independent of justifiable reasoning (Aarts et al., 1997) that is supported by the fact that, when the habit occurs once, it reduces the probability of receiving information about alternative travel modes (Verplanken et al., 1997). Thus, when people choose a travel behaviour, it is habitual nature that allows us to predict their future choices. Because of this, habit is very often used in theories and models explaining the travel mode choice.

3. METHODS

This review is based on the systematic selection of available literature in order to map the role of habit in travel mode choices. Sources within selected databases were used in order to produce this study (e.g., Academic Search Complete, Science Direct,

Scopus, Web of Science). Based on the criteria mentioned below, 1,136 studies were found. a large number overlapped. Subsequently, the selection was made in two levels. At first, the studies that considered the psychological aspects of travel mode choice or travel mode change were selected. This selection established the context for the issues of choice and change of travel mode. It included 58 studies. Second, the selections were short-listed if they included studies that were directly focused on the role of habit in travel mode choice or that took the role of habit into account. These 26 studies were used directly in order to meet the aim of the review. The available literature selection in the first level aims to outline the first pioneering theories related to this issue (e.g., Triandis, 1977), which supersede traditional behavioristic habit conceptions (e.g., Hull, 1943; Watson, 1914). Therefore, the available literature in the first selection was limited with the year 1970 as the bottom limit for publication date. The other level of literature selection had a bottom limit of 1990.

The key issues included “habit”, “travel mode”, and “car use”. On the first level, the selection was limited to psychological studies in the given topic. Studies mapping a given topic in the other areas were excluded (e.g. medical, economic, sociological, civil engineering, environmental, policy-oriented, network modeling approach or out off-topic). The selection was limited to academic studies. Other periodicals were excluded. On the second level, the selection was content based. In addition, lists of references from which other relevant studies were selected were checked for all the selected studies (i.e., the so-called ancestry approach, e.g. Gardner & Abraham, 2008; Lanzini & Khan, 2017). Consequently, all of the selected studies were connected to the role of habit in travel mode choice and divided in the following four fields: 1) the theoretical definition of the concept of habit, in general, and in the context of travel mode choice, in particular; 2) the theoretical bases of individual studies; 3) follow-up strategies for travel mode change; and 4) the measurements and methods used in the given field.

4. THEORETICAL BASES OF STUDIES RELATED TO TRAVEL MODE CHOICE

Lanzini and Khan (2017) distinguish three frameworks of research in the field of travel mode behaviour: 1) approaches based on the Theory of Planned

Behaviour (TPB) (Ajzen, 1991), which are the most popular (e.g., Gardner & Abraham, 2010; Yang-Walentin, Schmidt, Davidov, & Bamberg, 2004); 2) research projects based on the feeling of moral obligation (e.g., Norlund & Garvill, 2002); and 3) research projects based on habit (e.g., Aarts & Dijksterhuis, 2000). Habit, thus, represents just one of three research frameworks in this field. Several researchers (e.g., Banister, 1978; Goodwin, 1977; Verplanken et al., 1994) suggest that the decision-making process for travel mode choices are often automatic. In other words, traveling is often habitual. Some studies concerning travel mode choice primarily focus on the concept of habit (e.g., Friedrichsmeier et al., 2013); however, the majority of studies perceive habit as an extension of the existing theoretical models that deal with travel mode choice and its changes (e.g., Bamberg, Ajzen, & Schmidt, 2003a; Bamberg & Schmidt, 2003; Donald, Cooper, & Conchie, 2014; Eriksson, Garvill, & Nordlund, 2008; Forward, 2014; Klöckner, Matthies, & Hunecke, 2003; Klöckner & Matthies, 2004, 2009; Matthies, Klöckner, & Preißner, 2006; Polk, 2003; Staats, Harland, & Wilke, 2004; Thøgersen, 2009; Verplanken, Aarts, van Knippenberg, & Moonen 1998). The theoretical models used for the explanation of travel mode choice mostly include the TPB (Ajzen, 1991), the Norm Activation Model (Schwartz, 1977), and even the Value Belief Norm Theory (Stern et al., 1999; Stern, 2000). The base theories are used for deriving the areas of interest (e.g., contextual changes, attitudes, subjective norms) that can lead to changes.

It is important to separate habit from other similar concept – “Discrete choice models”. Thematically close “Discrete choice models”, often used as a theoretical background for choosing between modes of transport are deliberately neglected in this review. “Discrete choice models” are built on different concepts. The use of a transport mode is usually explored as its choice by decision analysis (Šimeček, 2019). This analysis serves primarily to determine the preferences of properties and subjective advantages of individual transport mode. Although decision analysis is being discussed in this context, the choice of transport mode may actually be the result of habit or imitation (Chartrand, 2005; Tanner et al., 2007). The subjective advantage of the desired mode of transport for the target group is, however, a necessary condition for their use. Only when it is fulfilled can people actually switch to public transport after breaking the habit.

4.1 Theoretical base in the Theory of Planned Behaviour

Regarding travel mode choice, it is the **Theory of Planned Behaviour** (e.g., Bamberg & Schmidt, 1998; de Bruijn, Kremers, Singh, Van den Putte, & Van Mechelen, 2009; Eriksson & Forward, 2011; Gardner & Abraham, 2010) or sometimes its modified or extended version (e.g., Haustein & Hunecke, 2007; Mann & Abraham, 2012; Noblet, Thøgersen, & Teisl, 2014), that is most commonly and empirically used in different forms. This article focuses on studies that complement this theory with the concept of habit and then empirically verifies the connection. Some studies are directly based on the TPB and complement it with the habit measurement (e.g., Bamberg et al., 2003a; Bamberg & Schmidt, 2003; Nordfjærn, Şimşekoğlu, & Rundmo, 2014; Staats et al., 2004; Verplanken et al., 1998). Other studies extend the TPB and add the habit measurement (e.g., Donald et al., 2014; Forward, 2014). The TPB (Ajzen, 1991) is a successor of the Theory of Reasoned Action (e.g., Ajzen & Fishbein, 1980). The TPB works with three main behaviour predictors: attitudes to exhibit certain behaviour (in this context, the person has a positive attitude to a certain travel mode); subjective norms, which reflect the feelings of social pressure (i.e., a person has a feeling of social pressure to use a particular travel mode); and, perceived behavioral control (i.e., a person believes they have the necessary skills and the opportunity to use a particular travel mode). These predictors form an intention which immediately precedes behaviour. Therefore, travel mode choice is a justified behaviour. Travel mode choice in the context of the TPB was investigated by Bamberg et al. (2003a). They also focused on the role of habit. They mapped the influence of past behaviour on future behaviour through habit while inducing a change to the context conditions. Independent measurements of habit as a mediator of this influence were generally not proven, and only when the circumstances stayed relatively stable. This led the researchers to conclude that travel mode choice is a widely justified decision. This decision can be influenced by interventions that cause changes in attitudes and subjective norms, and it may be perceived a behavioral control. In this concept, human social behaviour (travel mode choice, in this case) is perceived as justified, although it may contain automatic elements (Bamberg et al., 2003a). Verplanken et al. (1998) measured the antecedents of behaviour

defined by the TPB (i.e., attitudes, subjective norms, perceived behavioral control) and the strength of habits relevant for travel mode choice. Their measurements revealed that intentions are significantly associated with behaviour just when the habits that are relevant for travel mode choice are weak. If the habits are strong, there is no relationship between intention and behaviour. If the emphasis is placed on realizing the conditions under which travel behaviour is exhibited, the behaviour has a stronger relationship to the previously presented intentions. However, the relationship between habit and behaviour is not affected. Therefore, habits determine the boundary conditions for the usability of the TPB, even though external cues may increase the possibility for accepting intentions. Bamberg and Schmidt (2003) found that, if the habit measurement is included, the prediction of intentions and behaviour is more accurate. If models other than TPB are used as a complement to Ajzen's model (Schwartz, 1977; Triandis, 1977), the explanatory power of the habit is significantly increased. Staats et al. (2004) sought to influence travel behaviour through an intervention program (i.e., The Eco Team Program) by combining information, feedback, and social interactions in a group as part of a three-year longitudinal study. Their results show that long-term change can be predicted based on the interaction between intention, habit, and experienced social influence. Therefore, the above-mentioned studies show that TPB is an irreplaceable model and frequently used in research practice.

Another theory used for the explanation of travel behaviour is **the extended Theory of Planned Behaviour**. Donald et al. (2014) tested an extended model of the TPB. This model extends the predictors of behaviour with moral norms, descriptive norms, and environmental commitment. All these variables influence behaviour through intention and through habit. Empirical research confirmed that car use was determined by intention and habit, while public transport use was exclusively influenced by intention. The variables of the TPB indirectly influenced car use and public transport use through their effect on intention and habit (Donald et al., 2014). Further extension of the TPB with **the Transtheoretical Model of Behaviour Change** (Prochaska & DiClemente, 1983) was designed by Forward (2014). He understands the TPB to be continual and he complements it with a model of levels (e.g., a change is triggered by the number of steps).

The Transtheoretical Model includes six phases: 1. precontemplation (i.e., the person has no intention to change behaviour); 2. contemplation (i.e., the person is becoming aware of an issue and its consequences); 3. preparation (i.e., the person is getting prepared for a change); 4. action (i.e., the person changes their behaviour, but with a high risk of reverting); 5. maintenance phase (i.e., the new behaviour becomes a habit); and 6. termination (the new behaviour is so established that a return to the previous behaviour is improbable). This model provides an explanation for why, despite successful implementations of new behaviour in the target group (i.e., bicycle use in this case), behaviour is not performed in practice. The repetitive breakthrough of strong habits is referred to by Verplanken et al. (1997). When handling attention, it is possible to suppress habit in the beginning and increase the level of information processing. Thus, despite strong habits, it is possible to increase the motivation of individuals to get involved in more complex decisions. Nevertheless, if the habit is strong, the effects are still manifested in future trips. The results imply that the effects of the habit can be overcome, but just temporarily (Aarts et al., 1997). Empirical research (Forward, 2014) confirmed that the constructs of the TPB distinguished between respondents only in the phases of preparation and action. After the habit measurement was added it was clear that respondents' behaviour could be considered automatic in the first and last phases. Although the change brings benefits, it is necessary to map the negative consequences of the change and prepare enough space so that the new behaviour can be fixed. Otherwise, the new behaviour will not have a permanent and stable character (Forward, 2014). The Transtheoretical Model of Behaviour Change points out the significance of the maintenance phase, which comes after the desirable change (travel mode change, in this case), and shows that it is the actual way to create a new habit. Finally, there is the **Model of Goal-directed Behaviour**, which was used by Carrus, Passafaro, & Bonnes (2007) to extend the TPB with more predictors, including anticipated emotions (positive and negative); past behaviour; and a desire to behave in a certain way. Their results are related to using public transport instead of a car for trips to work and they show that negative anticipated emotions and past behaviour are significant predictors of the desire to get involved in a pro-environmental action.

4.2 Theoretical base in the Norm Activation Model

Another theoretical basis is the **Norm Activation Model** (Schwartz, 1977). This model is common among the studies that map travel mode choice and its change (e.g., de Groot, Steg, & Dicke, 2008; Harland, Staats, & Wilke, 1999; Hunecke, Blöbaum, Matthies, & Höger, 2001; Nordlund & Garvill, 2002). The Norm Activation Model focuses on the processes of moral norms and their transformation into action. It explains altruistic and environmental behaviors through these processes. It works with three antecedents of environmental behaviour: the awareness of consequences; the assignment of responsibility; and personal norms. The activation of personal norms comes with the awareness of potentially harmful consequences and the awareness of personal responsibility for non-environmental behaviour. The anticipated pride or feeling of guilt leads people to behave in line with their personal norms. In relation to travel behaviour, this model was extended with the concept of habit by Klöckner et al. (2003) and Klöckner & Matthies (2004, 2009). The researchers show that the personal norm of reducing car use is a strong predictor for travel mode choice. However, this is only valid without the effects of a contradictory habit. If the habit is strong, the norm activation process stops and neither the moral nor any other motivation is considered, and the context directly starts habitual behaviour. Habits mitigate the effects of personal norms on travel mode choice. They are predictors of the choice parallel to personal norms. If a person does not behave in accordance with norms, protection mechanisms are activated, including the refusal of responsibility and the creation of a new definition for a situation (Matthies et al., 2006). Later, Haustein, Klöckner, and Blöbaum (2009) and Klöckner and Matthies (2012) documented the effect of socialization (i.e., how much parents use public transport, the experience of receiving a driving license as an initiation into adulthood, multi-mobility within peer-group) on travel mode choice through habit. The extension of the Norm Activation Model to the effect of the habit can help explain why people often fail to behave in accordance with their moral motivation.

4.3 Theoretical base in the Value Belief Norm Theory

Value Belief Norm Theory (Stern et al., 1999; Stern, 2000) is an overview of theoretical concepts of pro-environmental behaviour. This theory was

also used for travel mode choice (e.g., Eriksson, Garvill, & Nordlund, 2006; Nordlund & Garvill, 2003; Nordlund & Westin, 2013). The Value Belief Norm Theory combines the theory of values (Schwartz, 1992), norm activation theory (Schwartz, 1977), and the New Environmental Paradigm (Stern, Dietz, & Guagnano, 1995). It works with a causal chain of variables (e.g., values, beliefs, personal norms) which lead to a specific travel mode choice. Every variable in the chain directly affects the others. Personal norms for pro-environmental behaviour are activated by beliefs that external conditions threaten individual values and that a person may act to limit the threat. In relation to the concept of habit, this theory was examined by, for example, Eriksson et al. (2008). In their study, they tried to find a way to break the habitual use of a car through extensive discussions with a research assistant that focused on the potential change in car use and the formulations of new so-called “implementation plans” (see below). Consequently, the travel mode choice became more intentional. The habit to use a car was weakened, while the relationship between car use and the personal norm was strengthened. The researchers confirmed the hypothesis that the intervention focused on influencing pro-environmental values and norms, and that a belief to act in compliance with them leads to a reduction in habitual car use.

4.4 Theoretical base in the Comprehensive Action Determination Model

An attempt to integrate theoretical approaches was made by the **Comprehensive Action Determination Model** (CADM) (Klöckner & Friedrichsmeier, 2011; Klöckner & Glöbaum, 2010). This model of environmental behaviour integrates the assumptions of the TPB, the Norm Activation Model, the theoretical conception of habit, and the ipsative theory of behaviour (based on Frey, 1988). In this concept, individual behaviour is directly determined by three sources — a process of intention, situational effects, and habitual processes — and indirectly determined by personal and social norms, which have an impact through intention processes and habitual processes. All of the sources interact. Habitual and situational processes interfere with intention processes and reduce the impact of intention on behaviour. Perceived behavioral control activates normative processes and intention processes, which influence situational effects. Klöckner and Glöbaum (2010) compared this

model with the TPB, the Norm Activation Model, and their combination. The Comprehensive Action Determination Model explains the highest degree of variation. Klöckner and Friedrichsmeier (2011) confirmed the sustainability of this model for the explanation of travel mode choice. Their study included 3,560 university students who recorded their choices for 26,863 trips. Regarding the explanation of the variation of individual personal preferences, the Comprehensive Action Determination Model was used, which, in this case, explains a 62% variation. Regarding situational effects, situation predictors (e.g., car availability, trip duration, day of travelling, public transport disruption, weather, daylight, trip purpose) were searched for, which, in this case, explains the 48% variation.

4.5 Other theoretical approaches

Besides habit, attitudes can also be found in the above-mentioned theories in different forms. Attitudes are traditionally accepted as one of the basic predictors of behaviour (e.g., Eagly & Chaiken, 1993). Some studies focus directly on their relationship to habits (e.g., Garvill, Marell, & Nordlund, 2003; Verplanken et al., 1994) or on the relationship between habit and motivation (e.g., Gardner, 2009). Specific theoretical classification can be complicated in those cases. **Habit and attitude relationship** are generally indicated by the above-mentioned model of attitude and behaviour relationship by Triandis (1977, 1980), who considers the probability of occurrence to be the result of habit and intention influenced by physiological excitement and objective conditions. If we view intention as formed by attitudes, subjective norms, and the perceived control of behaviour (Ajzen, 1991), or respectively as formed by past behaviour, attitudes, and subjective norms (e.g., Oullette & Wood, 1998), then we can expect attitudes to have a similar relationship as that for habits and intentions. In the context of travel mode choice, this assumption was confirmed by Verpelanken et al. (1994). The model works with the assumption that behaviour is a compromise between perceived costs and benefits. This model was often applied in travel mode choice studies (e.g., Gilbert & Foerster, 1977; Hartgen, 1974; Recker & Golob, 1976) which assumed that travel mode choice is based on attitudes towards available choices. According to the researchers, this is because travel behaviour is repetitive and done in stable conditions, thus the

travel mode choice is a habitual process rather than a justified behaviour. According to their findings and based on the assumptions of Triandis (1977, 1980), habits and attitudes interact in the prediction of decisions on travel mode choice in the future. If a habit is strong, the relationship between attitude and behaviour is weak. If the habit is weak, the relationship between attitude and behaviour is strong. With the increasing strength of habits, attitudes lose their predictiveness (Aarts et al., 1997; Verplanken et al., 1994; Verplanken et al., 1997).

Similar research focused on **the influence of intentions/motivation** was performed by Gardner (2009). His aim was to map the influence of motivation and habit on travel behaviour. The results show that the choice of commuting was stable over time and that habit and intention had a positive correlation. Commuters who formed a strong intention to use a certain travel mode more frequently used this mode, which led to the habit of using that particular travel mode. The results also confirm that habit weakens the relationship between motivation and behaviour. If a habit is strong, motivation no longer forms behaviour, which follows the theoretical assumption that the relationship between a habit and motivation is inversely proportional (Triandis, 1977, 1980). The researcher points out that if the effect of habit is not considered, the role of the decision processes for travel mode choice may be overrated. Therefore, it is always necessary to include a habit measurement when decision-making processes are measured (Gardner, 2009, Garvil et al., 2003). These studies document the meaningfulness of the association of the habit concept to the theoretical models that explain travel mode choice and its change, as well as the meaningfulness of the habit measurement when measuring separate categories, such as attitudes. Thus, models become more applicable in practice.

The strength of habit as a predictor of travel mode choice is thus justified (e.g., Gardner & Abraham, 2008; Gärling & Axhausen, 2003). Similarly, the role of habit as one of the correlates of car use is justified as well (e.g., Şimşekoğlu, Nordfjærn, Rundmo, 2015; Thomas & Walker, 2015), particularly for commuting to work or school (Nordfjærn, Lind, Şimşekoğlu, Jørgensen, Lund, & Rundmo, 2015) or in the case of walking or cycling (Thomas & Walker, 2015). One of the reasons is that the expected satisfaction with using public transportation decreases with the strength of the habit to use a car (Pedersen, Kristensson, & Friman, 2012). However,

as mentioned above, the concept of habit is not completely unanimous. Friedrichsmeier et al. (2013) performed research that focused on a comparison of the different habit concepts in terms of the fixation of the behaviour and the level of generality in the context of the travel mode choice. These findings imply that a combination of context stability and behavioral frequency is the main component of habit, as assumed by the associanistic approach (Friedrichsmeier et al., 2013). a range of studies (e.g. Fujii & Gärling, 2003) follow the concept of “**habit as an association**” for travel mode choice. In their approach, they usually trigger a context change and measure the consequent effects. They usually query the frequency of past behaviour and context stability. Apart from “habit as an association”, the concept of “**habit as script**” can be found in the studies of several other researchers (e.g., Donald et al., 2014; Fujii & Gärling, 2003; Gärling, Fujii, & Boe, 2001; Klöckner & Matthies, 2012). In that concept, the researchers follow older studies (e.g., Abelson, 1981; Schank, 1982; Svenson, 1990) that dealt with the issue of choice. They usually query what travel mode will be most likely used. However, the limits of both approaches are not quite clear, since both approaches may exceed their typical definition. The cross-section study of the design empirically confirms the justification of an approach based on scripts/schemes. The longitudinal study of the design empirically confirms the justification of connectionistic/associanistic approach.

5. CHANGES IN HABITS IN STUDIES FOCUSED ON TRAVEL MODE CHOICE

The aim of studies that deal with travel mode choice is to provide leads for successful change in favor of travel modes that are more environmentally friendly and less harmful to their users' health. Our aim is to map the conditions of travel mode choices in the context of habitual behaviour. The existing literature offers empirical verification for these changes in different variations that correspond to the initial theoretical position of the researchers. Changes in the context (e.g., starting to study at a new university; Wood et al., 2005), are traditionally emphasized within the change in habits. In this habit concept, the most successful strategies are probably those that prevent stabilized habitual behaviour and make it easier to form new habits. Changes in the context environment may break the automatic start and the performance of es-

established habits, which increases the significance of conscious intentions (Oullette & Wood, 1998). However, a successful intervention does not include only stimulation control in the sense of limited exposure to cues; it also includes their interconnection with a competitive response (Wood et al., 2005). People can improve their control over their habitual behaviour through the formation of inhibitions. Intensive inhibition contributes most to interventions in behavioural changes, like when the suppression of habitual behaviour is paired with learning and with the performance of a newly required response. Inhibition can be effective as a short-term strategy which suppresses a habitual reaction so that an opportunity to create a new, consistent goal appears. If a new reaction is repeated in a stable context, a new habit may be formed (Wood et al., 2005; Wood & Neal, 2007). Nevertheless, habitual behaviour, which is triggered by impulses, may be disrupted by changes in these impulses, while habitual behaviour, which is focused on reaching certain goals, may be disrupted by changes in the beliefs of these goals (Wood et al., 2005). The essential factor for changing habits is short-term rewards, not simply rewards with long-term character. With a lack of immediate evidence that the new behaviour will bring positive results, many people are unable to maintain the behaviour and fail to form a new habit. Past habits may be renewed thanks to speed and the ease with which they can be initiated and performed since they are compatible with context conditions and they are not contradictory to short-term goals. If new behaviour is to be maintained, the strategy of change needs to provide immediate positive consequences from the new behaviour. In addition, effective strategies should provide an opportunity to repeat new behaviour in a stable and supportive environment (Oullette & Wood, 1998).

Similarly, when mapping a change in travel mode choice, a natural change in the environment is used. It could be in the case of moving house (Verplanken, Walker, Davis, & Jurasek, 2008), graduating from university (Fujii & Gärling, 2003), injury (Musselwhite, Calcraft, Roberts, Fox, Swinkels, Turton, & Young, 2016), a temporary motorway closure (Fujii, Gärling & Kitamura, 2001) and the provision of various benefits related to using different travel modes than a car (Fujii & Kitamura, 2003; Bamberg et al., 2003a; Bamberg & Schmidt, 2001). In their study, Fujii and Kitamura (2003) offered drivers a free-of-charge bus pass for one month. Just before, just after, and one month after the end of this inter-

vention period, they measured the attitudes, habits, and frequency of car use. The results proved more positive attitudes to bus transport and an increase in bus use, while the habit of using a car had decreased even a month after the intervention period. Therefore, according to the researchers, a temporary structural change may be a tool for changing car transportation demand into public transportation demand. Similarly, Verplanken et al. (2008) proved the hypothesis that a contextual change, such as moving to a new house, may activate important values that lead to environmentally friendly behaviour. On the other hand, natural change in the environment which represents e.g. rail strike (Klößner & Friedrichsmeier, 2011; Rietveld & Exel, 2009), can lead against the desired direction. Rietveld & Exel (2009) demonstrated changes in travel behaviour (changing to car use, rescheduling to another day or even abandoning the trip).

In contrast, other studies primarily focus on triggering a deliberate choice process and measuring its impact on travel mode choice (e.g., Bamberg, 2000; Eriksson et al., 2008; Fujii & Taniguchi, 2005; Garvil et al., 2003). These studies are usually based on an implementation intention (Gollwitzer, 1993). The implementation intention connects expected critical situations and the desired target reactions. These desirable reactions are subsequently triggered automatically when they encounter a critical situation. The implementation intention is used when people are unable to change their goals in action. Eriksson et al. (2008) and Garvil et al. (2003) mapped the role of habit in relation to these approaches. The researchers work with the assumption that, in order to perform a change, car users must be motivated to limit their car use. The intervention aim was to consider limited car use and to formulate an implementation intention for a change in travel behaviour. First, the study participants filled in a prospective schedule for the car trips they planned for the following week. Then they introduced a list of different strategies to reduce the costs of personal car transport (e.g., travel mode change, destination change, cancellation, change of trips, car-pooling). For each trip planned for their personal car, the participants made the decision whether they wanted to limit their car use. In cases when they decided to limit their car trips, they created a strategy to reach the goal. Then they recorded the changes. When the participants did not plan to limit their car use, they stated the reasons that they thought they could not. Subsequently, the participants were asked to check

the changes in in the week that followed the one they planned. The researchers claim that this method made travel mode choice more intentional. The association between car use and the strength of habit was weakened and the relationship between car use and personal norm became stronger. Car use reduction by this method is particularly successful for people with strong habits and strong moral motivation (Eriksson et al., 2008).

Some studies combine natural changes in the environment and strengthen the conscious choice processes. In a situation of a change (e.g., moving to a new house), the studies focus on creating a personal time schedule for public transport use (Bamberg, 2006) or on a combination of information provision and a free pass (e.g., Bamberg, Rölle, & Weber, 2003b). In this regard, Mathies et al. (2006) investigated a two-level process of “defrosting” habitual behaviour and a technique for establishing voluntary commitment. They believe that a temporary change in the environment (i.e., free public transport) may weaken the connection between a situation and behaviour in order to trigger decision processes in which moral motives may be considered. Using the strategy of “defrosting” habitual behaviour generally supports any strategy that activates motives for alternative travel modes. The results show that moral motivation is a relevant predictor for travel mode choice, and it may be fixed with a commitment that is preceded by a temporary situational change. However, the total effect of interventions was considered small. Similarly, Bamberg et al. (2003b) complemented the above-mentioned context, which was caused by the change in the place of residence, with a provision of information and free public transport. The researchers built on the assumption that if car use had become automatic in the past, it would be resistant to a change. But their results failed to back their claim. Instead, the intervention influenced attitudes, subjective norms, and perceived behavioural control (in accordance with the TPB). They were identified as the main causes of change in travel behaviour.

6. HABIT MEASUREMENT FOCUSED ON TRAVEL MODE CHOICE

Habit has been operationalized by various researchers in the context of their theoretical bases. Some researchers (e.g., Bamberg, 2000; Landis, Triandis, & Adamopoulos, 1978; Triandis, 1977) understood

the frequency of behaviour to be an indicator of the strength of habit. Ouellette and Wood (1998) operationally defined a habit as past behaviour (e.g., behaviour from last week up to a year ago, or the weekly frequency of behaviour multiplied by intensity). Therefore, it is a self-report on past behaviour, but the habit needs to be distinguished from past behaviour. Habits are perceived as more complex. Repetitive behaviour is just a valid basis (see above). Later, Wood et al. (e.g. 2002, 2005) measured the strength of habit based on self-reporting as a frequency of past behaviour and the stability of support circumstances. Strong habits were defined as those that are performed often and in stable places. Weak habits are those that either reflect unusual effectiveness or changeable circumstances. Therefore, the researchers optimized habit measurement by considering both the frequency of performance and context stability.

Based on their theoretical concept of habit as a script, Verplanken et al. (1994) attempted to overcome the existing shortcomings. They followed the reviews of researchers (e.g., Beck & Ajzen, 1991; Mittal, 1988) that were based on an opinion that the previous and subsequent behaviour may correlate as a consequence of determinants different than habit (e.g., external conditions) that appear in both cases, and that repetitive behaviour is just a precondition for habit and not the habit itself. Their aim was to create a measurement method that did not include the frequency of past behaviour, did not use retrospective introspection, and was not applicable to a single trip. The assumption was that respondents will follow their personal scripts regarding travel behaviour. Their method included 10 statements about imaginary trips (“Let us suppose that you are planning a trip to the beach with several friends.”) and six travel options — bus, cycling, taxi, car, train, and walking. The respondents answer as quickly as possible. The idea was that fast answers to impulses with a minimum of details (e.g., destination, purpose of the trip) removed complicated choices. The strength of habit is the sum of the choices of certain travel behaviours. This method was called the Response-frequency Measure (RFM) (Verplanken & Aarts, 1999). The researchers used this method in a wide range of studies (e.g., Aarts et al., 1997, Aarts, Verplanken, & van Knippenberg, 1998; Haustein et al., 2009; Klöckner & Blöbaum, 2010; Matthies et al., 2006; Verplanken et al., 1994, 1997). Later, Verplanken and Orbell (2003) criticized the demanding nature of the meth-

od, which requires extensive piloting for each type of behaviour, and the demanding administration, which requires the presence of an administrator who is applying time pressure. Verplanken and Orbell (2003) created a habit index based on self-reporting for the habit measurement called the Self-Reported Habit Index (SRHI). It contains 12 items that comment on a certain behaviour (e.g., car travel). Answers are recorded in scales with poles I agree/I disagree. The index follows the concept of habit based on scripts. The aim is to cover various aspects of habitual behaviour that express the strength of habit: a history of behaviour repetition; behavioural control difficulty; the absence of conscious behaviour; behaviour effectiveness; and an identity element. This method was also adapted by a number of researchers (e.g., Eriksson et al., 2008; Haustein et al., 2009; Thomas & Walker, 2015), extended to 19 items (Nordfjærn et al., 2015; Şimşekoğlu et al., 2015), and narrowed down to six items (Klöckner & Blöbaum, 2010).

7. CONCLUSION

To conclude, the travel mode choice is usually a result of habit and intention, as summarized by Triandis (1977, 1980). Some approaches emphasize and elaborate on the conscious choice processes (e.g., de Bruijn et al., 2009; Eriksson & Forward, 2011; Gardner & Abraham, 2010). In this respect, the Theory of Planned Behaviour is the theory that is most common (Ajzen, 1991). It focuses on attitudes, personal norms, and perceived behavioural control as antecedents for the intention that immediately precedes the behaviour. Other approaches include the Norm Activation Model (Schwartz, 1977) and the Value Belief Norm Theory (Stern et al., 1999; Stern, 2000). Conscious choice processes the influence of a procedure, which is used for a change in travel mode use. The aim is usually to trigger conscious choice processes by influencing the attitudes, the norms, and the values of individuals. Several researchers believe that travel mode choices are automatic and habitual (e.g., Banister, 1978; Goodwin, 1977; Verplanken et al., 1994). Two main streams can be distinguished in the approaches that are focused on habit. They are identified as connectionistic/associative approaches and an approach based on scripts/schemes (Friedrichsmeier et al., 2013). In the connectionistic/associative approach, habit is understood to be a connection between context and behaviour, which

appears through frequent behaviour in a stable context. By contrast, the approach based on the scripts/schemes habit stands for behavioural ability, which is suitable or expected in certain situations and can be triggered without the previous processing of all of the aspects of the situation. The concept of habit is mainly reflected upon in the approach which is used for travel mode change. Context stability, which is viewed as one of the crucial habit components, is usually disrupted. Some researchers try to achieve integration on both the theoretical level and in research practice. An example of theoretical integration is the Comprehensive Action Determination Model (CADM) (Klöckner & Friedrichsmeier, 2011; Klöckner & Glöbaum, 2010). This model of environmental behaviour integrates assumptions of the TPB, Norm Activation Model, theoretical habit conception, and ipsative behaviour theory (based on Frey, 1988). In this concept, the individual behaviour is directly determined by three sources: by intention processes; by situational effects; and by habitual processes. Then it is indirectly determined by personal and social norms, which have an impact through both the intention processes and the habitual processes. In research practice, we can find studies that combine the disruption of the context stability and attempts to trigger conscious-choice processes by influencing attitudes, norms, and the values of people (e.g., Bamberg et al., 2003b; Mathies et al., 2006). Therefore, habit is irreplaceable in studies that map travel mode choice and its change. On the other hand, the whole process of travel mode choice should always be taken in its complex nature with all the above-mentioned conscious and automatic components. The table below gives an overview.

Based on the findings of this study it can be stated that, in the measurement of travel mode choice and in the attempts for behaviour change, habit is the strongest variable. Models that do not include habit as at least one of the variables have weak prediction strength. In this context, it is necessary to work with habit if policies or other measures that are focused on the support of more sustainable or more desirable ways for travel will be applied. As the most popular theory, TPB (and its various forms) still does not have sufficient predictive value and the combination of more methods is difficult to apply from practical reasons (e.g., difficulties with operationalization, time-demanding questionnaires) makes it necessary to develop new models based on habit that are supported by several other variables. Such a model

Tab.1: Theoretical background, change and measurement of habit in research on travel mode choice overview

Theoretical background, change and measurement of habit in research on travel mode choice					
Theoretical background	Represented studies	Changes in habits	Represented studies	Habit measurement	Represented studies
Habit as an extension of the TPB	Bamberg et al., 2003a Bamberg & Schmidt, 2003 Nordfjærn, Şimşekoğlu, & Rundmo, 2014 Staats et al., 2004 Verplanken et al., 1998	Natural changes in the environment		Habit as a frequency of behaviour	Bamberg, 2000 Landis, Triandis, & Adamopoulos, 1978 Triandis, 1977
		• Moving house	Verplanken et al., 2008	Habit as a frequency of behavior + the stability of support circumstances	
		• Graduating	Fujii & Gärling, 2003		Wood et al. 2002 Wood et al. 2005
The extended TPB		• Injury	Musselwhite et al., 2016		
• Moral norms, descriptive norms, environmental commitment	Donald et al., 2014				
• Transtheoretical Model of Behaviour Change	Forward, 2014	• Motorway closure	Fujii, Gärling & Kitamura, 2001		
• Goal-directed Behaviour	Carrus, Passafaro, & Bonnes, 2007	• Rail strike	Klöckner & Friedrichsmeier, 2011 Rietveld & Exel, 2009		
Habit as an extension of the Norm Activation Model	Klöckner et al., 2003 Klöckner & Matthies, 2004 Klöckner & Matthies, 2009 Matthies et al., 2006	Triggering of a deliberate choice process	Bamberg, 2000 Eriksson et al., 2008 Fujii & Taniguchi, 2005 Garvil et al., 2003	Response-frequency Measure	Verplanken & Aarts, 1999 Aarts et al., 1997 Aarts, Verplanken, & van Knippenberg, 1998 Haustein et al., 2009 Klöckner & Blöbaum, 2010 Matthies et al., 2006 Verplanken et al., 1994 Verplanken et al., 1997
• Socialization	Haustein, Klöckner, and Blöbaum, 2009 Klöckner and Matthies, 2012	Natural changes in the environment + strengthen the conscious process	Bamberg, 2006 Bamberg, Rölle, & Weber, 2003b Mathies et al., 2006		
Habit as an extension of the Value Belief Norm Theory	Eriksson et al., 2008				
Habit as an extension of the Comprehensive Action Determination Model	Klöckner & Friedrichsmeier, 2011 Klöckner & Glöbaum, 2010				
Other theoretical approaches					
• Habit and attitude relationship	Verpelanken et al. (1994 Verpelanken et al., 1997 Gilbert & Foerster, 1977 Hartgen, 1974 Recker & Golob, 1976			Self-Reported Habit Index	Verplanken and Orbell, 2003 Eriksson et al., 2008 Haustein et al., 2009 Thomas & Walker, 2015 Nordfjærn et al., 2015 Şimşekoğlu et al., 2015 Klöckner & Blöbaum, 2010
• The influence of intentions/ motivation	Gardner, 2009				
• Habit as an association	Friedrichsmeier et al., 2013 Fujii & Gärling, 2003				
• Habit as script	Donald et al., 2014 Fujii & Gärling, 2003 Gärling, Fujii, & Boe, 2001 Klöckner & Matthies, 2012				

is desirable now because disruptive changes in the transportation field are expected. The start of the automation era is expected to create a shift toward car sharing and to new travel modes — and even new ways of life. But these changes may be quite difficult to achieve when strong habits are connected to the old ways of traveling.

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