HOW BEST TO EVALUATE MOBILITY MANAGEMENT PROJECTS: CAN PSYCHOLOGICAL THEORY HELP?

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ABSTRACT

In order to persuade both policy makers and practitioners to adopt mobility management (MM) strategies there is a need for these decision makers to accept, understand and be able to predict (with confidence) their likely effectiveness. To satisfy these requirements there is a need for a greater understanding of how MM interventions affect individuals' modal choice decisions and robust evaluation techniques that will allow any behavioural changes to be observed. This paper considers three key questions, namely; [1] *Do mobility management type interventions work?,* [2] *How do MM interventions work?* and [3] *How best to measure their effects?* The paper then suggests practical solutions as to how these issues can be addressed, in the form of a new standardised evaluation resource: MaxSUMO, which contains advice on the use of more robust evaluation methods (e.g. randomised controlled type designs) and the inclusion of theoretical diagnostic procedures based on a new theoretical behavioural change model (MaxSEM) to measure individuals' stage positions (their susceptibility to change behaviour) and stage movement (progression towards actual behavioural change).

Mobility Management; Behavioural change; Evaluation methods; Modal choice

INTRODUCTION

Interest in mobility management (MM) type projects[1] has been growing worldwide as a potential solution to global environmental problems (e.g. Cairns *et al.,* 2004). However, despite the widespread uptake of such interventions more recently questions have been asked in relation to the actual impact that MM can achieve. This paper first considers three key questions, namely; [1] Do mobility management (MM) type interventions work?; [2] How do MM interventions work?; and [3] How best to measure their effects?. It then offers potential solutions in the form of a new behavioural change model, MaxSEM, and its associated attitudinal/perceptual diagnostic measurement questions, and a new theoretical-based evaluation resource: MaxSUMO.

Do MM interventions work? - do they change individuals' modal choice behaviours and if yes to what extent?

Evidence to support the effectiveness of mobility management strategies is increasingly well documented (e.g. Rye, 2002; Cairns *et al.* 2002; Steer Davies Gleave, 2003; Cairns *et al.*, 2004; GORS, 2005; Parker *et al.,* 2007), although there remain some inconsistencies in the actual extent of changes in behaviour reported (Möser & Bamberg, 2008).

In one of the most recent and comprehensive reviews of UK and international evidence (Cairns *et al.,* 2004) concluded that if MM (or 'soft transport policy') measures were given greater policy priority in the UK than at present, they had the 'potential' to achieve a reduction in peak urban traffic of about 21% (off peak 13%), and a UK nationwide reduction of all traffic of about 11%. The report also considered the potential impacts of individual MM measures and suggests that at a local level individual MM measures such as workplace travel plans have the potential to achieve between a 10-30% reduction in solo car use, school travel plans between 8-15%, and personalised travel planning initiatives between 7-15% (see Parker *et al.*, 2007; Brög, *et al.*, 2009 for a later review of personalised travel planning initiatives).

However a later meta-analytical review of 141 studies pertaining to the three types of MM measures cited above (including those documented by Cairns *et al.*, 2004; Steer Davies Gleave, 2003; and GORS, 2005) suggested a much lower potential of 7% (Möser and Bamberg, 2008).

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[1] Also known as 'Smarter choices' or 'Soft policy measures' in the UK, and 'Travel feedback programmes' in Japan. See the EPOMM website for a comprehensive definition of mobility management and associated measures (www.epomm.org/)

Similarly for the three individual types of measures lower effect estimates of 12% for workplace travel plans, 5% for personalised travel planning[2] were suggested and for school travel plans the authors were unable to provide any conclusive estimates of their effects. More recent work (DfT, 2009) has also cast doubt on the robustness of the assumptions made by Cairns *et al.* (2004).

Möser and Bamberg concluded that this inconsistency is due in part to the typical methods used to evaluate interventions, which are lacking in 'empirical vigour' and more recently, similar concerns have been raised by other authors, which although made in the context of personalised travel planning type interventions apply to all other MM measure types. These include;

- The use of one-group pre-post test evaluations designs which restrict the ability to establish 'cause and effect', primarily due to the lack of control over external influences (Möser and Bamberg, 2008) and seasonality effects (Bonsall, 2009);
- Weak analytical techniques to synthesize the data obtained, for example the use of less objective narrative-style analysis (Möser and Bamberg, 2008) or failure to provide detail on the analytical procedures used (Goulias, 2001);
- Sample sizes too small to allow statistical effects to be established (e.g. Richardson, 2002; Stopher & Greaves, 2004; Morton & Mees, 2005; Möser and Bamberg, 2008);
- Related to the above, the use of unrepresentative samples (Bonsall, 2009);
- A tendency to report only 'good practice' case studies (Möser and Bamberg, 2008);
- Over reliance on self-reported travel behaviour (Stopher & Bullock, 2003; Bonsall, 2009) which can lead to 'measurement error' in terms of under or over reporting of trip (Stopher *et al.*, 2009) which may in part be due to 'halo effects', i.e. respondents wishing to appear more 'greener' than they actually are in terms of travel mode choices, and/or as complying to the studies aims or wider (e.g. Morton & Mees, 2005); and
- The lack of robust corroborative data to confirm self-reported measures such as the use of odometers readings (Seethaler & Rose, 2009) bus patronage data (Parker et al 2007), or GPS readings (Stopher *et al.,* 2007).

More detailed descriptions of these issues are available in Möser and Bamberg (2008) and Bonsall (2009).

How do they work?

In order to successfully change people's travel behaviour, it is essential for practitioners and policy makers to understand the underlying processes necessary for behavioural change to occur, and to use this knowledge in both the design and evaluation of MM projects. Most relevant to the evaluation of MM projects are two key facts, as follows:

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[2] A joint rebuttal to the conclusions made by Möser and Bamberg in relation to personal travel planning has been prepared by SUSTRANS and SOCIALDATA, although not yet published at this time.

Firstly, in any given population some people are more susceptible, or ready to change their travel behaviour than others (Curtis & Headicar, 1997; Anderson & Stradling 2004; Anable, 2005). This partly relates to more subjective factors such as peoples' attitudes, perceptions and level of confidence towards their current travel mode choices, and towards alternative travel choices, as well as their wish to actually change their travel mode behaviour. In this context, if people currently have negative perceptions and attitudes towards alternative modes, little or no confidence in using other modes, or see no reason to change modes they will be unlikely to do so. The role of MM interventions should be to attempt to change these attitudes and perceptions, and instil confidence in a positive way in order to motivate people to try out, and ultimately adopt new travel mode behaviours. For other people the barriers to modal shift are more objective: for example, if there is no bus service operating on the route for their journey they could not switch to local buses for that journey, or if they have a mobility-impairment that prevents them from switching car trips to traditional bus services, cycling or walking. In this instance MM interventions alone would be unlikely to change people's travel behaviour, and 'harder' more infrastructural measures would have to be implemented first or simultaneously (such as the addition of new bus services, or Demand Responsive Services for mobility-impaired people). The role of MM would be more supplementary in ways such as increasing awareness of these new services (via travel awareness campaigns), or provision of free tickets to entice people to try new services.

Secondly, it is increasingly acknowledged that in many instances behavioural change does not occur as a one-step process and can instead be viewed as a series of transitional stages (or steps) which individuals progress through in order to reach the final stage of behavioural change (e.g. Prochaska & DiClemente, 1984; Gatersleben & Appleton, 2007; Bamberg, 2007).

Accordingly, the implications are that any MM intervention is likely to affect people in different ways based on their susceptibility to change behaviour and stage position within the behavioural change process. Further, evaluations that focus on behavioural change *per se*, would not detect any of the more subtle attitudinal and perceptual changes that would also occur as people progress to later stages of readiness to change (Carreno & Welsch, 2009).

However, despite knowledge of these facts there remains no consensual theoretical framework that explains the behavioural change process involved in modal shift (see Anable *et al.,* 2006; Darnton, 2008; MAX-SUCCESS, 2008a for recent reviews). Previously, researchers have attempted to 'explain' modal choice decisions using a range of pre-existing theoretical frameworks, including the Theory of Planned Behaviour (Heath & Gifford, 2002; Bamberg *et al.*, 2003); Norm Activation Model (Hunecke *et al.*, 2001); Transtheoretical Model (Gatersleben & Appleton (2007); and Model of Action Phases (Bamberg (2007).

The lack of consensus as to which framework is the most appropriate remains due to the lack of validation studies that have applied these theoretical principles in actual modal choice studies. The relatively few studies that have attempted to test theoretical based interventions typically focus on individual behavioural change model constructs, such as Goal setting (Fujii & Taniguchi, 2005); Attitudes towards non-car modes (Beale & Bonsall, 2006; Fujii, 2007);

Goal feasibility (Oja *et al.*, 1998); Implementation intention (Bamberg, 2000), rather than actual behavioural change process models as a whole.

How best to measure their effects?

As part of the wider MAX project[3], a state-of-the-art (SoA) review noted that at present there remains a lack of any standardized advice and 'practical' tools to allow MM type interventions to be evaluated (MAX, 2008b). Although, earlier European funded research projects (e.g. TAPESTRY, MOST) have made recommendations and suggested data collection techniques, such as MOST-MET (The monitoring and evaluation toolkit of the MOST Project) and CAG (The Campaign Assessment guidance of the TAPESTRY Project) the take up of these outputs is not widespread. Additionally, UK developed methods such as iTRACE (http://itrace.org.uk/) and SAM (Standard Assessment Monitoring- http://www.trics.org/sam/default.html) have been developed, although are designed to be measure-specific (i.e. focused on workplace/school travel plans) and are limited (as with CAG) to their application to the full range of MM measures.

The MAX report concluded that there remains a need for such guidance and advice that is both user-friendly enough to facilitate its uptake, but detailed enough to allow the required quality of data to be collected (to address the methodological weakness identified earlier), and also to incorporate a theoretical underpinning (to address the theoretical considerations discussed in the previous section) to allow the evaluation of all types of MM projects. After reviewing available methods, the SoA review suggested that the Swedish designed SUMO tool[4] as the most suitable for further development. However, it would have to address three key issues;

[1] How to ensure that the measurement incorporates the full range of attitudinal and perceptual constructs that are known to be important in affecting behavioural change?

[2] How to measure such changes in attitudes and perceptions in an objective way?

[3] How to ensure that more robust evaluations are performed?

MaxSEM and its associated stage diagnostic questions (see next section) allows the first of these two issues to be addressed and MaxSUMO (see later) provides an evaluation framework based on robust methodological principles to address the third.

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[3] MAX-SUCCESS was the EU's latest FP6 framework research project on Mobility Management and Travel Awareness in transport. Full details of the project are available at http://www.max-success.eu/.
[4] SUMO (System for the evaluation of Mobility Projects) is a 'user friendlier' version of MOST-MET (the evaluation toolkit evolving from the MOST project) that has been adopted by the Swedish Road Administration (SRA) for the evaluation of SRA co-financed travel behaviour projects.

MAXSEM (MAX-SELF REGULATION MODEL)

MaxSEM is a newly developed theoretical model designed to explain individual's modal choice decisions. MaxSEM has evolved following an extensive literature review of existing theoretical models (MAX, 2008b) and independent research of one of this papers co-authors (Sebastian Bamberg) which resulted in the identification of the most important aspects (constructs) that are relevant in explaining individuals' modal choice decisions and the underlying process that are involved in switching from car-use to more sustainable transport choices. MaxSEM has subsequently been extensively validated, first in a cross-cultural survey involving seven European countries and then as part of a large scale real-life intervention study conducted in Munich (see MAX-SUCCESS, 2009 for details), and pilot study in Hammersmith (Carreno *et al.,* 2009). MaxSEM provides a theoretical framework describing the behavioural change process and explains individuals' readiness to change travel mode by categorising them in one of four stages:

Stage 1: Pre-contemplative stage. Individuals in this stage typically make most of their trips by car, are quite happy with the way they currently travel (i.e. as car drivers) and at the moment have no wish, or desire to change to another mode, or feel that it would be impossible for them to do so at the present time, whether this be through subjective or objective reasons (see earlier).

Stage 2: Contemplative stage. Individuals in this stage also typically make most of their trips by car, but are not as content with their current travel behaviour (as pre-contemplators). They would like to reduce their level of car use and change to another way of travelling, but at the moment are unsure of which mode to switch to, or perhaps don't have enough confidence to do so. They are not really sure which alternative mode [s] they could use, or when they will begin replacing their car trips.

Stage 3: Preparation/Action stage. Individuals in this stage also typically make most of their trips by car, but have decided which replacement mode they intend to switch some or all of their car trips to, have the confidence to do so and may have already tried this new mode for some of their trips.

Stage 4: Maintenance stage. Individuals in this stage typically make most or all of their trips by non-car alternatives (public transport, walking, cycling etc.). These can either be people who do not own or have access to a car for their trips (and therefore dependent on non-car modes for travelling), or people who do own/have access to cars but for various reasons use them very infrequently, or not at all.

These stages can be viewed as a series of steps, leading up to the final step of actual behavioural change. Although the steps are fundamentally different from each other and follow on from each other in a logical way, it is possible for some stages to be missed (e.g.

pre-contemplators could move directly to preparations/action or maintenance stages) or backward movement (stage regression) to occur.

In order for people to progress from earlier to later stages, key **threshold** points (shaded in Fig. 1) have to be 'satisfied'. So for pre-contemplators to become contemplators the key is the formation of a **'Goal Intention'** (i.e. they have to recognise their current level of car use is 'problematic' and want to reduce it). For people to form a goal intention, several factors (or constructs- shown by un-shaded boxes in Fig 1.) are known to be important, although the importance of each construct will differ on an individual basis. For example, for some people the key factor may be for them to 'feel bad' about their current level of car use (Negative affect) and for others they may feel that to reduce their car use at the current time is not a realistic option (goal feasibility) etc. Once in the contemplative stage, they then have to identify which would be the most suitable option (which mode) for them to reduce their car use, and feel sufficiently positive towards (Attitudes towards different behavioural change strategies) and/or confident (Perceived behavioural control) to use this alternative non-car mode and a **Behavioural Intention** is formed. The transition into the final Maintenance Stage involves individuals making definite plans and/or possibly trying out the new mode choice, which is conceptualised by an **Implementation intention**, and ultimately this new behaviour becomes their new normal dominant mode behaviour.

MaxSEM's stage diagnostic questions

In order to objectively measure individuals' stage positions within MaxSEM, MAX researchers have developed a set of six simple questions. The questions have evolved from a series of validation studies conducted across Europe within the MAX project (see MAX, 2009 for details). The questions (shown in Table 1) require respondents to indicate which **one** of the six statements best reflects their current attitudes towards their current level of car use and intentions towards future car use. According to the answers given (which box did they tick), respondents can then be grouped into one of MaxSEM's four stages (see final column).
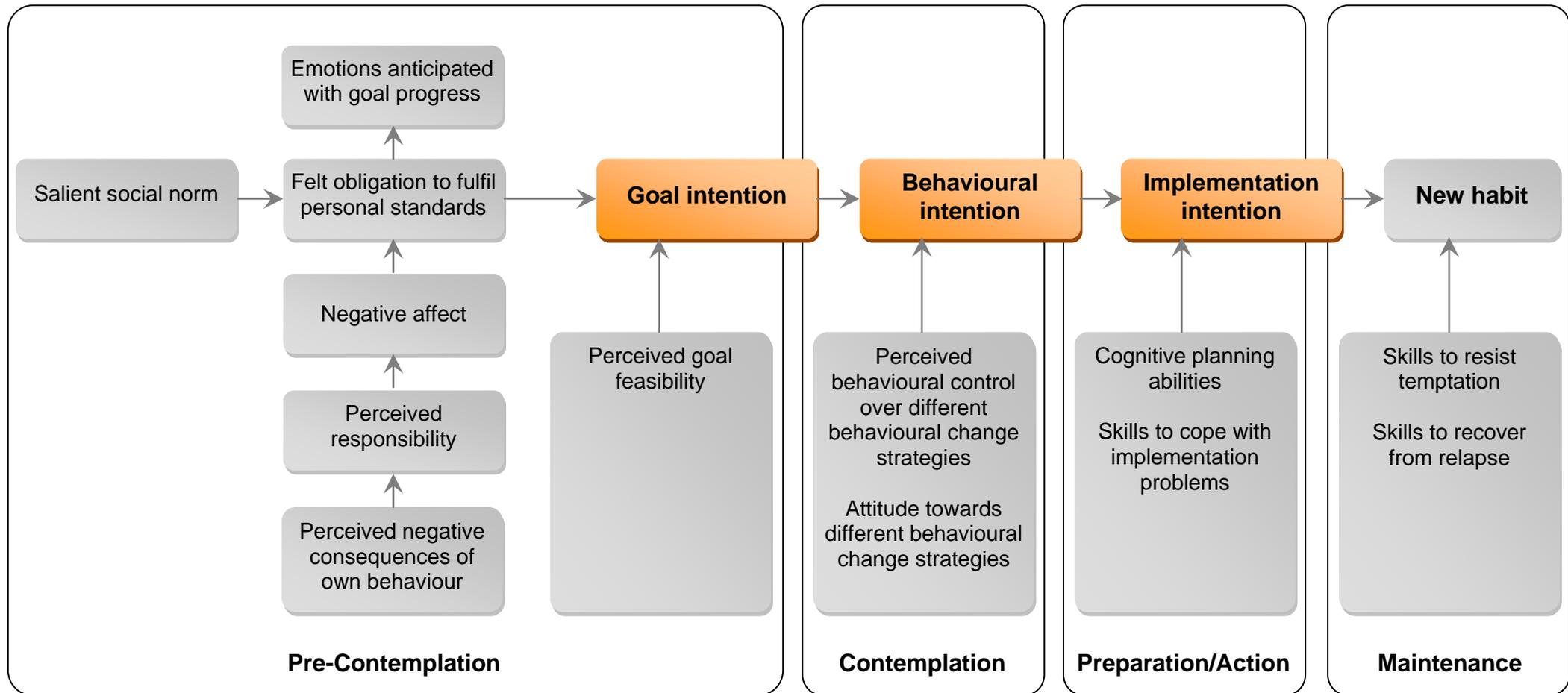
Fig 1: Overview of MaxSem

Table 1: Standardised stage diagnostic questions and allocated stage position

Question: Which of the following statement best describes how you currently feel about your level of car use and whether you have any plans to try and reduce any of these car trips? Please tick only one box.		Stage allocation
At the moment I use the car for most of my trips. I am happy with my current level of car use and see no reason why I should change it.	☐	**Pre-contemplative**
At the moment I do use the car for most of my trips. I would like to reduce my current level of car use, but feel at the moment it would be impossible for me to do so.	☐	
At the moment I do use the car for most of my trips. I am currently thinking about changing some or all of these trips to non-car modes, but at the moment I am unsure how I can.	☐	**Contemplative**
At the moment I use the car for most of my trips, but it is my aim to reduce my current level of car use. I already know which trips I will replace and which alternative transport mode I will use, but as yet have not actually put this into practice.	☐	**Preparation/testing**
As I do not own/have access to a car, reducing my level of car use is not currently an issue for me.	☐	**Maintenance**
As I am aware of the many problems associated with car use, I already try to use non-car modes as much as possible. I will maintain or even reduce my already low level of car use in the future.	☐	

MAXSUMO

Evolving from the review of available evaluation methods (MAX-SUCCESS, 2008b) the Swedish developed SUMO evaluation tool was identified as the most suitable resource for future development, and following major revisions evolved into MaxSUMO.

MaxSUMO like its predecessor SUMO allows evaluation of a range of MM type projects and the online guide provides step-by-step guidance for users to effectively plan, monitor and evaluate MM projects. The design of MaxSUMO is simple and the methods included are not

significantly different from other guidelines for transport and public policy evaluations. However, MaxSUMO is unusual in how its targets, indicators and results can be specified at different levels (see Fig 2), which allow changes to be observed at various stages of the MM project process, related to the type and details of the MM project implemented (services provided), the new travel behaviour the MM intervention is aiming to promote (mobility option provided), and also the impact of the MM intervention at both an individual and system level (overall effects)- see . Most importantly although simple to apply, it is based on the MaxSEM theoretical framework and incorporates this knowledge into the evaluation process via the inclusion of the stage diagnostic questions. To address methodological issues it also contains a chapter discussing 'cause and effect' issues and guidance on robust evaluation methods, along with sample survey instruments (see Hyllenius *et al.*, 2009)
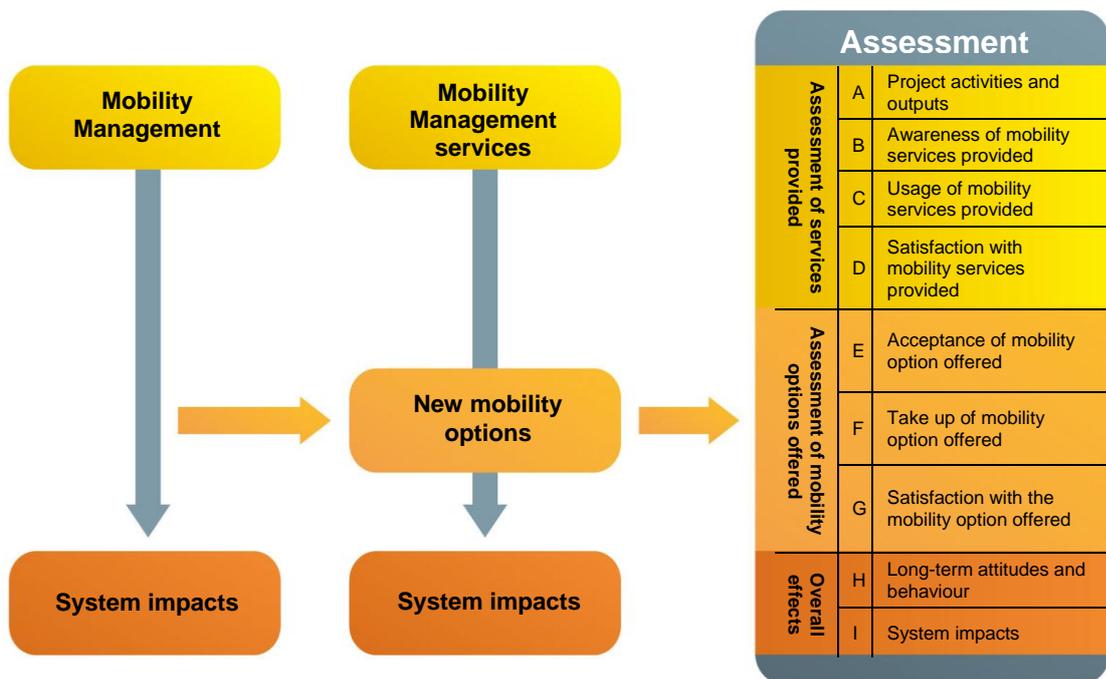

Fig. 2: Overview of MaxSUMO levels

CONCLUSIONS

This paper set out to address three key questions relating to how and to what extent MM type interventions work and also how to best measure their effects.

Firstly, there is considerable evidence that MM interventions do work, although, as noted by Möser and Bamberg (2008) the precise effects in terms of behavioral change remains unclear. Further, current understanding of the behavioral change process recognizes that MM type interventions are likely to affect many individuals in more subtle ways (than behavioral change), although the precise impacts of different MM measures in effecting such

changes is yet unclear. To enhance current knowledge in these areas, a toolkit of useful resources has been produced within the MAX project, and MaxSEM, it's stage diagnostic questions and the MaxSUMO evaluation resource will in time help address these issues. However, further refinements/practical guidance specifically in relation to aspects such as the use of appropriate sample sizes (e.g. Richardson, 2002) and supplementary objective measures (e.g. Stopher *et al.,* 2009) is required.

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ACKNOWLEGMENTS