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THE IMPACT OF AUTOMOBILE TRAFFIC ON QUALITY OF LIFE

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ABSTRACT

We consider how quality of life is affected by the continuing increase in the use and density of automobiles. We propose that sustainable transportation implies finding a proper balance between collective and individual interests, because a fully sustainable transport system is difficult to envision if most citizens believe it will significantly reduce their quality of life. Approaches to measuring quality of life, its relation to sustainable transport alternatives, and the potential implications for informing transport policy are considered.

INTRODUCTION

Automobile use has greatly increased during the last few decades. The number of passenger kilometres by private car per capita increased by 90 per cent in western Europe and 13 per cent in the US between 1970 and 1990. Drivers may be unaware how much they drive. When asked to prospectively estimate how many trips they would take during the next week, Swedish drivers took 80 per cent more trips than they expected to take (Jakobsson, 2004). How do these objective increases in the use of automobiles, and the subjective lack of awareness about it, affect quality of life (QoL)?

Automobile use threatens environmental quality, urban QoL, and the accessibility of important destinations. Many observers have argued that the current transportation system is not sustainable (e.g., OECD, 1996; see also Chapter 2 by Van Wee). Increased automobile use may affect people and environments in ways other than sustainability in

a purely economic sense, including negative effects on such QoL elements as health. For example, each added daily hour spent in a car adds six per cent to one's chances of being obese (Frank *et al.*, 2004).

This chapter focuses on private transport, especially car use, because about 80 per cent of all vehicles are used for passenger transport. It introduces an instrument for assessing the QoL effects of differing transport plans and for enabling the examination of the degree to which sustainable transport policies are acceptable to the public. Psychological factors that affect individual QoL judgments and the acceptability of transport plans are reviewed. Finally, some conclusions and the practical value of instruments for assessing sustainable transport are offered.

DEFINING AND MEASURING QUALITY OF LIFE

QoL is a multidimensional construct that may be defined as the extent to which important values and needs are fulfilled (e.g., Diener, 1995; Diener *et al.*, 1999). QoL refers to well-being, conceptualized either in terms of objective living conditions or as a person's own assessment of his or her well-being in life, or both. This chapter primarily focuses on the well-being aspects of QoL as experienced, that is, individuals' cognitive and affective evaluations of their lives (Diener, 2000).

A group of researchers centred at the University of Groningen has recently developed an instrument to measure a comprehensive list of experiential QoL indicators, and linked them to various sustainability issues (see Slotegraaf and Vlek, 1996; Skolnik, 1997; Vlek *et al.*, 1998, 1999; Gatersleben, 2000; Poortinga *et al.*, 2001, 2004; Steg *et al.*, 2002; De Groot and Steg, 2006a, 2006b). This list appears to represent a wide range of non-overlapping dimensions that are important to community members, at least in the Netherlands.

Table 1 presents the most recent version of this QoL instrument. The mean importance rating of each QoL indicator is included, based on data from a questionnaire study of 455 Dutch respondents in 1999 (see Poortinga *et al.*, 2001, 2004, for more details). The table shows that most QoL indicators naturally are considered to be very important by these respondents, but some are valued more than others. Health, partner and family, social justice, freedom, and safety are valued more highly (at least were by Dutch people in 1999) than material beauty, spirituality and religion, status and recognition, and challenge and excitement.

QUALITY OF LIFE RELATED TO SUSTAINABLE TRANSPORT

A sufficient QoL is an important precondition for sustainable development. Although no single definition of sustainable development is universally accepted, several fairly

Table 1: Description and Importance Ratings of 22 QoL Indicators

Indicator	Description	M
Health	Being in good health. Having access to adequate health care	4.9
Partner and family	Having an intimate relationship. Having a stable family life and good family relationships	4.7
Social justice	Having equal opportunities and the same possibilities and rights as others. Being treated in a just manner	4.7
Freedom	Freedom and control over the course of one's life, to be able to decide for yourself, what you will do, when and how	4.5
Safety	Being safe at home and in the streets. Being able to avoid accidents and being protected against criminality	4.5
Education	Having the opportunity to get a good education and to develop one's general knowledge	4.3
Identity/self-respect	Having sufficient self-respect and being able to develop one's own identity	4.2
Privacy	Having the opportunity to be yourself, to do your own things and to have a place of your own	4.2
Environmental quality	Having access to clean air, water, and soil. Having and maintaining good environmental quality	4.2
Social relations	Having good relationships with friends, colleagues, and neighbours. Being able to maintain contacts and to make new ones	4.2
Work	Having or being able to find a job and being able to fulfil it as pleasantly as possible	4.2
Security	Feeling attended to and cared for by others	4.1
Nature/biodiversity	Being able to enjoy natural landscapes, parks, and forests. Assurance of the continued existence of plants and animals and maintenance of biodiversity	4.1
Leisure time	Having enough time after work and household work and being able to spend this time satisfactorily	4.0
Money/income	Having enough money to buy and to do the things that are necessary and pleasing	3.6
Comfort	Having a comfortable and easy daily life	3.5
Aesthetic beauty	Being able to enjoy the beauty of nature and culture	3.5
Change/variation	Having a varied life. Experiencing as many things as possible	3.3
Challenge/excitement	Taking up challenges and experiencing pleasant and exciting things	3.2
Status/recognition	Being appreciated and respected by others	3.0
Spirituality/religion	Being able to live a life with the emphasis on spirituality and/or with your own religious persuasion	2.9
Material beauty	Having nice possessions in and around the house	2.6

Source: Adapted from Poortinga *et al.* (2004).

convergent definitions are available (Beatley, 1995). Sustainable development implies a balance between current and future environmental, social, and economic considerations (e.g., WCED, 1987; Ruckelhaus, 1989; OECD, 1996; Litman, 2003). Exactly how these considerations should be balanced is less clear. Although various attempts have been made to define, in particular, indicators of sustainable transport (see below), a set that adequately reflects environmental, social, and economic qualities has not yet been identified.

Ideally, theory-based conceptions and operationalizations of sustainable transport indicators should be developed, first by defining sustainable transport, and then by deriving significant performance indicators that enable the measurement of sustainable transport. At present, many performance indicators have been derived from current practices (e.g., in transport plans and policies) and stakeholder perceptions of sustainable transport. Indicator development often has not been based on an explicit definition or vision of sustainable transport (Gilbert and Tanguay, 2000).

The sustainability of transportation systems might be considered by examining objective positive and negative features and externalities of traffic and transport as they are apparent now or in the near future. Various attempts have been made to list these, such as energy use, CO_2 emissions, emissions of toxic and harmful substances, land use, disruption and fragmentation of natural areas, waste, traffic safety, noise pollution, health consequences of transport, accident costs, the contribution of the transport sector to economic welfare, and accessibility (e.g., Gilbert and Tanguay, 2000; Gudmundsson, 2001; Litman, 2003). Other objective indicators have been defined that are based on the quality of the current transport system, including commuting speed, congestion delay, variety and quality of transport options available in a community, accessibility of activities (for drivers and non-drivers), and the proportion of household expenditures devoted to transport (e.g., Litman, 2003).

Discussions on sustainable development focus on environmental sustainability. Indicators are also needed to examine effects of environmentally sustainable (and unsustainable) transportation systems on QoL. Social indicators should reflect effects on QoL (e.g., OECD, 1976, 1982). In one recent study that examined the effect of potential transport scenarios on social indicators (Geurs and Van Wee, 2000), environmentally sustainable transport criteria, such as emissions of CO_2, NO_x, VOS, particles, noise, and land use, were defined. Then, three environmentally sustainable transport scenarios that would meet these criteria were developed, following a backcasting method: a high-technology scenario (only technological changes), a mobility-change scenario (only behaviour changes aimed to reduce car dependency), and a combination scenario (technological and behavioural changes). Next, the policy measures that would be needed to reach these environmentally sustainable transport systems were identified. Finally, the possible social consequences of the combination scenario were compared to those of a business-as-usual scenario. The social effects were qualitatively assessed by experts, and thus might be considered a hybrid of objective and experiential forms of QoL assessment.

The authors concluded that the social consequences of environmentally sustainable transport scenarios appear to be less drastic than is often assumed. However, Geurs and Van Wee (2002) focused on a relatively small number of social indicators (safety, health, perceived environmental qualities, and community relationships), when numerous other social indicators, such as equity, freedom, convenience, and comfort, may also be affected by future transport scenarios. Of particular interest to this chapter, Geurs and Van Wee assert that there is a need for the timely implementation of measurement instruments.

Prescriptive studies like these are important for examining whether and how sustainable transportation systems are feasible. They clarify what a sustainable future might look like. However, an important subsequent question is: How does the public evaluate such sustainable futures? Is a sustainable transport system widely acceptable? The answers will depend, among other things, on the extent to which members of the public believe that these futures will result in an increase or at least not a reduction in their QoL. Improvements in the collective QoL, as embodied in sustainable transport, may conflict with individual short-term interests, especially when individuals must adapt their lifestyles in order to reach sustainability goals. Thus, collective and individual interests may be at odds, or at least appear so to some citizens. A sustainable transport system may actually improve QoL by increasing the amount a driver walks or rides a bike, for example, but many drivers may not be ready to see the value of these alternatives.

Nevertheless, sustainable transport issues often seem to contrast individual with collective goals. To achieve a sustainable transport system, drivers may well have to drive less. For many, driving a car is more attractive than other modes of transport, because of its convenience, independence, flexibility, comfort, speed, perceived safety, and privacy. The car also provides more status and pleasure than other modes of transport; it is a means of self-expression, and enables one to control a powerful machine (e.g., Reser, 1980; Steg, 2003a, 2005).

Thus, improved QoL for citizens in general may imply that drivers forfeit some of the individual advantages of car use, which may (at least initially) be perceived as a threat to their individual QoL. Among those who may especially be affected are those who live far from public transport, those who routinely transport several passengers, such as parents with children, and the elderly, many of whom believe they need to drive to maintain their independence, lifestyle, social ties, and access to shopping and services (Rudinger *et al.*, 2006). These citizens, and others, are inclined to drive, that is, to act in their own interest, because these interests are experienced as important and immediate, whereas the collective problems of steadily increasing traffic are visible only in the long term. Moreover, individuals *qua* individuals cannot control the problems caused by car use. Thus, to them, foregoing the advantages of driving does not seem sensible, at least in the usual everyday life in which long-term outcomes have low salience.

However, various factors may encourage citizens to act in the common interest, even though doing so may not have immediate positive consequences for themselves. Some of these factors include problem awareness (e.g., Nordlund and Garvill, 2003), perceived responsibility for the problem, trust in others' contributions, consideration of future consequences (Joireman *et al.*, 2004), and personal norms (see Gifford, 2002; Steg, 2003c, for overviews).

From these considerations, one may conclude that not only should the sustainability of different transport scenarios for society as a whole be examined, but also the extent to which such scenarios affect individual QoL and whether such scenarios are acceptable to individual members of society. More specifically, knowing which elements of different sustainability scenarios have high or low public acceptance would be important. Obviously, one can hardly expect sustainable transport to be implemented by governments if most citizens believe that it will significantly reduce their QoL. Indeed, the Brundtland Commission Report's own definition of sustainability implies the importance of QoL: "meeting the needs of the present without compromising the ability of future generations to meet their own needs" (WCED, 1987, p. 43). Thus, sustainable transport must also be concerned with human needs at the individual level as well as at the societal level. The effects of strategies aimed at creating sustainable transport should also be assessed in terms of human needs and values.

A reasonable assertion that follows from this is that policymakers should give special attention to possible effects on the most important QoL indicators when they design and implement sustainable transport policies. Apart from this obvious conclusion, policymakers are likely to hear from the public when they fail to do this: citizens can be expected to more strongly oppose measures that negatively affect these QoL indicators. Policymakers must search for ways to achieve sustainable transport that would affect these QoL indicators in less negative, or even in positive, ways. They might also consider possible ways to compensate any expected negative effects. The assessment of the needs of individuals must be done by consulting individuals, partly because individuals will support (vote for) or not (vote against) those who propose policies based on their needs as they experience them. Therefore, an instrument for measuring these QoL indicators is essential.

QUALITY OF LIFE, THE ENVIRONMENT, AND TRANSPORTATION

QoL often is viewed by the average citizen as primarily related to the quality of relationships, their own health, the health of significant others, finances, work, and social life (e.g., Bowling and Windsor, 2001). Environmental effects on QoL are not often considered, either by members of the public or by researchers, although a poor environment

can scarcely avoid compromising a person's QoL. Perhaps, the relatively good quality of environments in the industrialized world, where virtually all research is conducted, causes citizens and researchers to overlook its importance. However, some attention has been given to QoL in relation to the quality of the environment (Eyles, 1990; Rogerson, 1995; Cairns, 1997; Dasgupta, 2001).

QoL effects of transportation scenarios or plans may be assessed by asking lay respondents to indicate the extent to which various sustainable transportation scenarios would affect relevant QoL indicators in positive or negative ways. To obtain a more precise view of these effects, these expected changes may be weighted, based on the importance judgments of the relevant QoL indicators, because changes in important QoL indicators presumably will be more significant for individuals than changes in less-important QoL indicators. Subsequently, the overall expected changes in QoL may be calculated. A multi-attribute QoL scale may then be created by summing the expected changes on the QoL indicators, each multiplied by the importance judgment assigned to it. It should be noted that such an approach does assume an "involved" decision maker, and the average citizen rarely actively evaluates which transportation choice is best. Decision-making by the "uninvolved" citizen may be better explained by a variety of other decision-making models that emphasize habit, mindlessness, or "fast and frugal" criteria (Gigerenzer and Todd, 1999). Drivers typically have many things on their minds in their daily lives besides sustainability, and must be "cognitive misers" (Fiske and Neuberg, 1990) to survive and prosper.

The QoL instrument has been successfully used in several studies of sustainable household consumption (e.g., Vlek *et al.*, 1998; Gatersleben, 2000; Steg *et al.*, 2002). One Dutch study involving transport examined the extent to which sustainable household energy consumption scenarios would affect the judged QoL (Poortinga *et al.*, 2001). Scenarios were presented that systematically varied on three dimensions, one of which concerned the locus of energy saving (home versus transport). The respondents expected the transport scenarios would result in QoL reductions in comfort, work, money, privacy, and freedom. However, improvements in QoL were expected in nature/biodiversity and environmental qualities. Overall QoL appeared not to be affected much, which implies that the expected improvements nearly compensated for the expected reductions in QoL. The respondents expected the most negative consequences from the transport scenario that involved technological as well as behavioural changes that would result in small energy savings.

In another study, participants in five European countries (i.e., Austria, the Czech Republic, Italy, Sweden, and the Netherlands) evaluated the extent to which a doubling of the costs of car use would affect the 22 QoL aspects listed in Table 1. Next, they indicated to what extent this measure would affect their overall QoL as well (De Groot and Steg, 2006a, 2006b). In general, respondents anticipated negative effects for certain QoL indicators like comfort, money and income, leisure time, change and variation, freedom and work, but they believed that other QoL indicators (environmental quality, nature

and biodiversity, and safety) would improve. Differences among the five countries were found: respondents from the Netherlands and Sweden were more pessimistic about the QoL consequences of the policy than respondents from the Czech Republic, Italy and, to a lesser degree, Austria. Interestingly, the sum of expected changes in QoL indicators (i.e., the sum of expected positive and negative changes) was correlated with the expected changes in overall QoL (i.e., the overall judgement of expected changes in QoL), which suggests that the QoL instrument is a valid way to elicit judgements of expected changes in QoL of sustainable transport scenarios.

FACTORS THAT INFLUENCE EXPERIENTIAL QUALITY OF LIFE

Based on the studies reviewed above, we believe that the QoL concept is useful for assessing the expected effects of future scenarios. They not only reveal that QoL judgments are affected by various transport plans, but also how they are affected, that is, which QoL indicators would improve and which would deteriorate. The studies reveal that deteriorations in specific QoL indicators may be compensated for by improvements in other dimensions, at least when drivers are actively involved in thinking about transportation choices. Sustainable scenarios typically threaten some experienced QoL indicators such as comfort, freedom, and privacy, whereas QoL indicators that refer to societal indicators such as environmental quality and nature and biodiversity would improve. This once again illustrates the conflict between individual and collective interests, and demonstrates that individual and collective interests must be balanced. However, other experienced QoL indicators, such as health and the need for variety and change may improve once drivers discover the value of walking or riding a bike, so that the trade-off for individuals is not necessarily all loss.

Most studies reported above (except Steg *et al.*, 2002) examined only anticipated changes in QoL, that is, respondents indicated to what extent they expected their QoL to be affected in such cases. These may differ from actual QoL changes that would occur when the proposed changes would be implemented. For example, studies of the acceptability of transport policies have shown that public support may be higher after transport policies have been implemented (Tretvik, 2003; see also Steg, 2003b), even though changes typically are resisted at first because they may have negative consequences. When individuals are unsure of the consequences, they prefer the status quo (Kahneman and Tversky, 1984). Nevertheless, support for changes may increase after the changes occur, when respondents' opinions are better informed because they have more experience with the pros and cons of the measures.

For example, attitudes towards bus riding improved and bus riding increased after a policy change, that is, the implementation of a U-Pass that allowed free bus transport for

students after a mandatory addition to their University tuition fees (Heath and Gifford, 2002). In two Paris districts, after 30 km per hour traffic restriction zones were implemented, residents' evaluation of their sonic environment and their reported QoL improved (Rozec, 2003). The two zones had sonic environments with fewer traffic characteristics and more human sounds, including conversation and other elements of the soundscapes, compared to other zones. Individuals may also become more convinced of the advantages of the new policies because they perceive that collective problems are being solved.

Similar processes may play a role when people are asked to assess what changes in QoL they would expect from future (transport) scenarios. Therefore, the QoL concept should also be used to monitor QoL over time and to examine the extent to which changes in society or in transport affect judged QoL. This highlights the importance of the way in which future scenarios are presented. To ensure that respondents provide well-considered judgments of expected QoL effects of transport plans, the plans should be described in a plausible and imaginable way. Clear description of proposed changes in the transport system is important for helping respondents to think through the possible consequences of the plans for themselves. The public should also be involved in the development of sustainable transport plans. This should result in better and more acceptable sustainable transport plans.

A few other factors should be considered when examining QoL effects of sustainable transport scenarios. Diener *et al*. (1999) found that general subjective well-being has not changed much over the last several decades, even though incomes and consumption levels have increased significantly (see also Veenhoven, 2004). Individuals seem to adapt to positive as well as to negative changes in their lives; they change their expectations and goals (e.g., Meyers, 1992; Suh *et al*., 1996; Diener, 2000). QoL is judged in comparison to some social or personal standard (Ormel *et al*., 1997; Diener, 2000). People seem to feel more satisfied with their lives when they believe that they are better off than others are, when they are better off than yesterday, or when they are closer to their aspirations. The standards used to judge QoL do change over time, that is, individuals appear to adapt their comparative standards to changes in their circumstances (which might improve or deteriorate).

All this implies that further increases in consumption levels, including transport, will not necessarily enhance QoL, and that reductions in consumption and transport levels may not necessarily reduce QoL. Although individuals may initially experience a reduction in QoL, they may well adapt soon after the changes (Diener, 2000). Thus, the conviction that a sustainable transportation system is not feasible because environmentally sound transportation systems will seriously threaten QoL may not be correct, and should at least be tested.

Theories of QoL and human well-being typically assume that a general set of indicators for QoL can be defined that does not differ over time or between cultures (e.g., Maslow,

1954; Rokeach, 1973; Schwartz and Bilsky, 1987, 1990; Max-Neef, 1991; Schwartz, 1992; see Vlek *et al.*, 1999, for a review). However, the way individuals prefer to fulfil their needs and values does change over time and differs between cultures. Moreover, the relative importance of various QoL indicators (or needs and values) differs between groups (see Inglehart, 1990; Gatersleben and Vlek, 1998; Gatersleben, 2000; Poortinga *et al.*, 2001). For example, Dutch respondents with greater environmental concern evaluate environmental quality and personal freedom as more important, and material wealth as less important than do respondents with less environmental concern. Dutch women value personal freedom and maturity more than men do, and unmarried persons evaluate family, health, and safety as less important than couples and families do (Poortinga *et al.*, 2001). The relative importance of environmental values also depends on the context. For example, the relative importance of one's environmental values varies with the presumed immediacy of the environmental impact or economic gain, self-interest, and social norm (Heath and Gifford, 2006). The view that values are situation-independent does not appear to be valid.

Obviously, current and future sustainable forms of transport may affect various groups in society differently, and group differences may exist in what is considered to be sustainable (or livable) transport (see also Button, 1982; Adams, 1999). Consequently, the interests of various groups should be balanced, and it may be necessary to compensate groups that are disproportionately affected by current and future transport systems. Also, the relative importance of QoL indicators may vary over time (see Inglehart, 1990; Gatersleben, 2000). This implies that the multi-attributive evaluation of QoL effects of sustainable transport scenarios may be time-dependent. Which QoL aspects should be considered is known, but the relative importance of various QoL aspects, and consequently, overall (multi-attributive) QoL effects should be monitored regularly. This will also reveal to what extent actual QoL effects differ from anticipated effects. Based on these considerations, policies for developing sustainability may need to be adapted.

TRANSPORT AND THE ULTIMATE QUALITY OF LIFE INDICATORS: ACCIDENTS, INJURIES, AND DEATH

Experiential QoL is an important construct, particularly given the connection between public opinion and policy-making. However, certain objective statistics also bear on the experiential nature of the issue. Those pertaining to accidents, injuries, and death perhaps have the most dramatic negative impact on both the objective and experienced QoL of survivors, their families, and friends. Serious accidents change the life of victims, friends, family, and even guilty parties, such as the drunk driver who fatally injures someone else. In the United States, 44 per cent of all accidental deaths occur as a result of motor vehicle accidents. In round numbers, about 45,000 people have been killed every year in the US over the last 30 years (retrieved February 10, 2006, from

www.benbest.com/lifeext/causes.html). This is about the same number of American lives lost during the entire Vietnam War. Although this number has been declining in recent years (from about 52,000 to about 42,000), the US thus experiences approximately a Vietnam-War level of lost lives every year. Furthermore, the 45,000 figure does not include the much larger number of citizens who are injured, nor the emotional loss to the hundreds of thousands of others associated with the death or severe injury to a family member, friend, or employment associate. Losses in Europe are smaller, but are in rough proportion; for example, traffic deaths in Germany have fallen from about 21,000 to 7,000 per year recently.

But how does this relate to sustainable transport and experienced QoL? Assuming that buses are, in general, more sustainable than automobiles, greater use of buses probably would reduce the enormous accident toll, because buses are safer. Per passenger mile, automobiles are 25 times more likely to lead to death than buses (retrieved February 10, 2006, from www.benbest.com/lifeext/causes.html). Incidentally, motorcycles are 35 times more likely to lead to death, on a per-mile basis, than automobiles, which suggests that they are over 800 times as dangerous as buses. Data are difficult to come by, but one might guess that metropolitan subway trains, as another sustainable form of transport, are even safer than buses, which must share the road with cars. Turning to injuries, motor vehicle accidents very often leave their victim with cases of posttraumatic stress disorder, which of course severely affects their QoL (e.g., Cagnetta and Cicognani, 1999; Gudmundsdottir *et al.*, 2004). Thus, automobile accidents have a large impact on society, and a huge impact on the QoL of those who are directly affected.

SIGNIFICANCE FOR POLICYMAKING

As noted earlier, policymakers should take into account the extent to which their policies will affect judged QoL. Transport policies will be less acceptable, and consequently, less feasible and less effective, if they have significant negative impacts on QoL. Policymakers may be reluctant to implement policies that lack public support. Moreover, restrictions on freedom of choice may evoke psychological reactance (Brehm, 1966). As a consequence, restrictive policies may be less effective, or even have effects opposite from what was intended (Tertoolen *et al.*, 1998). If specific transport policies aimed at reducing car use are believed to threaten freedom of choice, drivers might be motivated to continue driving to the extent to which possible negative consequences will be bearable. Policies that restrict driving should emphasize the potential benefits of not driving, such as improved health from walking or riding bikes to the value of a change in routine and increased variety of daily experience.

Sustainable transport may imply different things in different regions and cultures, and consequently, specific sustainable transport plans may be evaluated differently in these

regions and cultures. For example, North American society is more strongly tuned towards the regular use of cars than many European societies. Of course, inter-city distances in Canada and parts of the US are much greater than those in European countries such as the Netherlands. Also, the public transport system in the Netherlands is sophisticated compared to that in many parts of North America. Thus, car dependency (i.e., the level of car use, car-oriented land use and quality of travel alternatives; Newman and Kenworthy, 1999) is much higher in North America compared to the Netherlands.

This implies that reductions in car use may have more significant consequences for the QoL of North Americans than for the Dutch. Differences may also emerge when comparing regions within a country. For example, as demonstrated by Rozec (2003), reductions in traffic volume may significantly enhance the QoL of people in densely populated areas (e.g., fewer traffic jams, less noise, better urban QoL), but may reduce the QoL of rural dwellers (e.g., some key locations and activities may be much more difficult to access).

CONCLUSIONS

Although no common definition of sustainable transport exists, most observers would agree that sustainable transport implies balancing current and future economic, social, and environmental qualities. Current traffic and transport trends do not appear sustainable in the long term, yet a standardized set of sustainable transport indicators has not yet been identified. The negative environmental, social, and economic externalities of current transport systems often outweigh their social and economic values. Sustainable transport mainly is investigated by examining the sustainability of current transport systems, such as the positive and negative values and externalities related to energy and land use, waste, traffic safety, traffic noise, health consequences, accident costs, accessibility, and economic wealth. Governments and international bodies such as the Organisation for Economic Co-operation and Development (OECD) often apply this approach. Sustainability indicators are defined and operationalised as sustainable transport policy goals, and whether the transport system is moving towards sustainability is monitored. In some cases future projections are also made.

In addition, the effects of various transport plans on sustainability are being assessed. This implies a need to consider a broader range of sustainability indicators, because changes in current transport systems may affect other sectors that also contribute to unsustainable development, such as employment levels or health care costs. Various methods and models have been developed to assess economic, social, and environmental consequences of transport plans. However, at present, only a few social indicators are being considered, because of the lack of knowledge and valid methods, tools, and techniques for assessing relevant social impacts.

Obviously, an important question concerns how the public evaluates such sustainable futures, and whether transitions to sustainable transport systems are acceptable to the public. These transitions may not be acceptable to everyone, because sustainable transport may conflict with some individual short-term interests, especially when individual car users are asked to significantly adapt their lifestyles and transport behaviour. Therefore, the extent to which transitions to sustainable transport would affect individual QoL should be examined, and also the extent to which such transitions will be acceptable to the public.

This chapter proposes a compensatory method for assessing the QoL effects of transitions to transportation systems that systematically differ in the extent to which they are sustainable. QoL is a multidimensional construct defined as the extent to which important values and needs are fulfilled. Subjective evaluations of QoL, that is, cognitive evaluations of citizens' lives as a whole, are considered. A list of 22 QoL indicators is introduced for assessing QoL effects of transport policy plans; the list represents a wide range of dimensions that are important to consumers (and thus travellers).

The effects on QoL of possible transportation scenarios may be assessed by asking respondents to indicate to what extent various transportation scenarios would affect relevant QoL indicators, and how important each indicator is to their lives. The overall expected changes in QoL may be calculated by summing the expected changes on the QoL indicators, possibly after multiplying the importance assigned to each indicator. Several empirical studies revealed that the QoL concept is useful for assessing actual and expected QoL effects of various sustainable transport scenarios. However, such studies, whether theory- or policy-oriented, require that respondents be awake to the issues involved; many everyday transport users are not actively involved in deciding which transport method is best for them or for society.

Such studies reveal not only whether overall QoL is or would be affected by transport plans, but also how QoL would be affected, that is, which QoL indicators would improve or deteriorate under different sustainable transport scenarios. Once the results are known, their implementation may require massive awareness campaigns so that the recommended changes are received by drivers who are actively cognizant of the issues involved. Research in consumer psychology shows that campaigns aimed at involved consumers do not work as well with uninvolved consumers, for whom a different kind of publicity campaign is required (e.g., Greenwald and Leavitt, 1984; Solomon *et al.*, 2005).

The proposed list of experiential QoL indicators enables examination of which groups' QoL would be affected most strongly. Based on this, politicians and policymakers should be able to decide whether and how specific groups should be compensated, and which indicators with potential salutogenic outcomes might be emphasized, to better inform the public about expected (positive and negative) effects of the proposed sustainable policies.

This would greatly improve the current situation, in which decisions are largely based on the preferences of special-interest groups. At present, significant minorities that wield sufficient political power often are able to obstruct particular solutions or compromises, which leaves governments with options that are unacceptable to others, or watered down so much that their effectiveness becomes questionable.

The objective and experiential approaches described above are not contradictory; they complement each other. QoL effects of both kinds must be considered when designing and implementing sustainable transport plans, because they are crucial for the acceptability, and consequently, the feasibility and effectiveness, of such plans. Sustainable transport plans will be strongly opposed when citizens start believing that the plans will significantly reduce their QoL.

To improve the chances for sustainable development, the basis of the expectations that sustainable transport will reduce QoL must be investigated. If the expectations are realistic, policymakers should consider other ways to achieve sustainable transport that would affect QoL less negatively, or even positively. The extent to which possible negative effects could be compensated, for instance, by implementing additional policies, should be examined. However, it may also be that such expectations are based on misperceptions or a lack of knowledge (e.g., the public is unaware of environmental problems caused by automobile traffic). In this case, the public should be informed and educated to the need for, and possible consequences of, sustainable transport.

The list of indicators introduced in this chapter may be used to collect community members' assessments of the changes in QoL that would be anticipated if possible future scenarios were to be enacted. Many psychological processes will influence these judgments. For example, well-considered judgments about the expected QoL effects of transport plans may not be obtained if respondents do not think enough about the advantages and disadvantages of sustainable transport compared to a business-as-usual scenario. This might be facilitated by providing citizens or study respondents with clear descriptions or visualizations of plausible changes in transport, and by describing what each one implies for them personally. Members of the public must be involved in the development of sustainable transport scenarios.

Changes understandably are met with initial resistance, as long as individuals are unconvinced of the salutogenic consequences. Individuals generally judge their expected QoL in comparison to some standard, for instance, the QoL of others, their current QoL, or their aspirations. These standards are adapted in response to changes in their circumstances. This implies that changes in transport may initially negatively influence QoL, but if individuals adapt fairly quickly, significant reductions in QoL may not occur in the long term. Thus, support for sustainable transport plans may become stronger after they have been implemented. Finally, because the relative importance of QoL indicators may vary over time, the expected and actual changes in QoL

of sustainable transport scenarios should be monitored continuously, and policies should be adapted when necessary.

Although much important work has been done to understand sustainable transport, many questions still remain. First, the methods used for assessing sustainable transport and for assessing QoL effects of sustainable transport scenarios need to be further developed. For example, methods must be developed to examine how valid judgments can best be collected, and how psychological processes that may affect QoL evaluations can best be understood. Second, whether the results of studies like the ones reported here may be generalized to transport behaviour in everyday life need to be examined. As noted earlier, a multiattribute model may be especially appropriate when citizen involvement is high, but other models are necessary when involvement is low, as it often is. The everyday preferences of many citizens might be better predicted by fast-and-frugal or noncompensatory models. Third, whether the present list of QoL indicators is comprehensive should be investigated. Although the list in Table 1 is believed to be complete, additions and changes may be needed. Fourth, relations among QoL indicators should be examined more thoroughly. For example, some QoL indicators refer to goals (e.g., comfort, status, affection), but others refer to resources (e.g., money, time, or health) that may be used to fulfil these goals (see Ormel *et al.*, 1997). Thus, the indicators may be found to consist of factors such as goals versus resources, or may form other clusters, which could simplify the structure of the full list, and therefore reduce the complexity of the relations between transport system proposals and QoL.

The development of sustainable transport scenarios should be combined with assessments of QoL effects of those scenarios. On the one hand, individuals may assess the QoL effects of transport plans that fulfil general sustainability criteria. On the other, scientists may assess the sustainability of transport plans that optimize QoL of current as well as future generations.

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