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DIFFERENT LIFESTYLES AND THEIR IMPACT ON THE ENVIRONMENT

Per Christensen, Aalborg University, Aalborg, Denmark

The transition to a sustainable society is happening too slowly. Although many changes have been introduced in public policies to ensure the greening of industry, these steps towards sustainability are insufficient unless individual households also contribute. This study tries to show that households have very different impacts on the environment. A difference in lifestyle, i.e. how we choose to live, be transported and choose our provisions, can have a dramatic impact on the environment. Based on life cycle assessment the environmental impacts from cradle to grave of different lifestyles have been calculated. The study shows that there are large differences among the analysed families. The 'American lifestyle' family, which is very dependent on transport by car, lives in its own large house and eats a lot of meat, pollutes eight times as much as the analysed 'green' family. The study thus demonstrates that it is necessary to influence lifestyles as a logical next step in the transition to a sustainable society. © 1997 by John Wiley & Sons, Ltd. and ERP Environment *Sustainable Development*, Vol. 5, 30–35 (1997)

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IMPACT OF DIFFERENT LIFESTYLES ON THE ENVIRONMENT

During the 1980s the concept of sustainability became a new, fashionable buzzword that was adopted by different organizations, political parties and even different states and the EU. The concept, as outlined in the Brundtland commission's report *Our Common Future* is not very precise. Some see this as an advantage because it allows politicians and industry to support the idea, but others resist the use of the word for precisely the same reasons, seeing the concept as a cover up that allows the continuation of the present state of affairs while other, more drastic measures are in fact asked for.

Nevertheless, the idea has established itself as a core concept for many of the present discussions about development and environment. Many activities are taking place which clearly indicate that things are beginning to change. National policies are now, at least in northern Europe, beginning to integrate sustainability considerations. Environmental planning, as well as regional and municipal planning, is beginning to adopt new goals and to use new means, and many industries are 'greening', e.g. adopting new environmental management systems and life cycle assessments.

Despite these efforts, the importance of which we should not underestimate, things are still developing in the wrong direction (Meadows *et al.*, 1991). The transition to sustainability is not fast enough. It is our perception that the reason for this is that the measures are not radical enough. Of course, the industries and government should do more, but that would not be sufficient because the traditional ways of outlining environmental measures are not in themselves sufficient. Traditionally, policies try to affect the output from the production processes (waste streams) or, more recently, the impacts from the products during their whole life cycle. This concept reduces the environmental problem to only two sources, production processes and products, and ignores the impacts from existing infrastructures and lifestyles.

It is obvious that already existing infrastructures (e.g. the highways and district heating systems) not only pollute when they are built and maintained, but also determine the means of transportation for wider parts of the population. The same considerations could be applied to the 'adoption' of different lifestyles. The reduction of pollution is, of course, also an effect of better production processes and the use of more environmentally friendly raw materials, but this will not in itself lead to a sustainable society. Consumption patterns must be changed so that consumption decreases and shifts from more polluting products and services to ones which are less polluting. This probably implies a shift in lifestyle in the entire population.

In a new research project we are trying to outline the positive environmental impacts associated with a change in lifestyle (Karlsen and Kørnov, 1994). In existing life cycle analyses there is a huge amount of data related to the production of different products (from resource extraction, production, transportation, consumption and disposal). We have gathered these data with a view to the major components of lifestyles. We define lifestyles as a cluster of different habits that to different extents are embedded in societal infrastructures. The habits considered are related to housing, transportation, heating and electricity, as well as provisions. Each of these habits can be accomplished in different ways, where some ways have a greater environmental impact than others. The combination of habits in different families leads to vast differences when it comes to environmental impacts. This study tries to identify the components of the prevailing modern lifestyles most damaging to the environment and to identify a more sustainable 'combination of habits' among modern lifestyles.

PRESENTATION OF THE FOUR LIFESTYLES

With a view to an analysis of the impacts of different lifestyles, we have chosen to outline four lifestyles that are fairly different with regard to consumer behaviour, but also with regard to their embeddedness in and dependence on different infrastructures. Thus we are emphasizing both the different degrees of freedom as well as the structural dependence of the families when it comes to their possible impact on their own share of global environmental problems.

Family A (two adults and two children) have a typical 'American lifestyle' with two careers. They are probably consultants or accountants. They have two cars which travel 25,000 and 15,000 km / yr, respectively. They have an ordinary house of 144 square metres. Heating is supplied by an oil burner. They eat more meat than the average family.

Family B (two adults and two children) are a more average household with two careers. They only have one car, which travels 15,000 km / yr and the rest of the household use bikes. They also have a house of 144 square metres. Heating is by a district heating system, which is supplied by a coal-fired power plant that co-generates heat and electricity. They eat an average amount of meat.

Family C (two adults and two children) have a typical (modest) 'green lifestyle' with two careers. They do not have a car, but use public transportation for 15,000 km / yr and they also use bikes. They have an ordinary house of 125 square metres. Heating and electricity are also supplied from a district heating system based on a coal-fired plant that co-generates electricity. They eat the same amount of meat as the average population, but all the meat they buy is of 'organic origin'.

Family D (two adults and two children) have a radical 'green lifestyle' with two careers, but these were consciously chosen within a proper distance from home so they only use their bikes for transportation. They have a fairly large 'low-energy' house where part of the heating is provided by a solar heating system and a windmill provides all the electricity used. They also eat 'organic grown' foodstuffs, but eat more vegetables (here calculated as wheat) and less meat than average.

The analysis of the different lifestyles is constructed so that they reflect a variety of options between different, but very common, habits or lifestyles that are all represented and accepted in our societies. This includes different ways of organizing and solving the problems of transportation, energy supply, housing and provisions. The variations are chosen to underline that some differences are caused by different personal choices, whereas others are caused by the way infrastructures are constructed.

In this sense this is a reformist, middle of the road scenario. To provoke more dramatic reductions in environmental impacts other alternative lifestyles could have been chosen, ranging from primitive hunter and food-gatherer to an organic farmer in the Lake District. However, these alternatives are not very acceptable to the public. In addition, we do not know the precise environmental impact of organic farming in the Lake District: how do they provide the totality of their foodstuffs, buildings, leisure, transportation and so on. This would, however, be a very interesting topic for future research, although I would make a guess on their environmental impact that would place them closer to the four lifestyles that we have analysed here than to the primitive hunter and food-gatherer.

The four families analysed are in all cases composed of two adults and two children. This is not done to maintain and propagate a narrow and traditional view of the nuclear family, but should only be taken as the starting point of the analysis. Later elaborations of the analysis could reveal how the fragmentation of family structures affects the environmental impacts of a population where an increasing number of people are living as ‘singles’ and parents do not always live together during the years when the children are raised.

LIFE CYCLE ASSESSMENT

Life cycle assessment is a fairly new methodology (Lai, 1993) aiming to calculate or describe the total environmental impacts of a given activity from cradle to grave; from resource extraction, through manufacturing, use and final disposal whether in recycling, incineration or land deposits (Pesso, 1993).

Life cycle assessment is different from ordinary environmental impact assessments precisely because the impacts on other places in the life cycle are also considered. It means that impacts are traced over wider geographical areas and over wider time spans and then summed up to give an account of the global impacts of the activity.

Life cycle assessment is different from traditional environmental impact assessment in the consideration of the cumulated impacts through the whole life cycle. Take, for example, transportation. When we traditionally compare different forms of transportation we calculate the amount of energy used to transport one person or one tonne for one kilometre. The difference can then be accounted for in certain amounts of kilojoules. When we make a life cycle assessment we have to consider not only energy used for the service itself, but also the energy and material used for the production of cars, aeroplanes, buses and trains, and the energy and material used to produce the fuel for the different means of transportation. One litre of gasoline used in the car is not just one litre of gasoline plus the environmental impacts caused by its combustion. It is also an additional amount of energy and environmental impacts caused by the extraction of oil. All the impacts must be seen as cumulated impacts.

Life cycle assessments are not an easy way to calculate environmental impacts. Several problems are related to this methodology.

The quality of data is often low and heterogeneous. When we seek information, especially about the extraction and manufacturing of different goods (trains or gasoline), it is often very difficult to obtain information at all. Often the data you find is not established by the use of the same criteria or definition of the problem: are the data then comparable? Normally you can find some mean values describing the manufacturing of steel or oil. But if the train is made at a specific plant, you can often find huge deviations between the environmental impacts and these mean values. Steel is not just steel. Steel made in Eastern Europe by old-fashioned technologies often gives a much higher ‘energy content’ and environmental impact than steel manufactured in Western Europe. Should you rely on mean values or instead try to establish more specific relationships? This problem is difficult to solve because it also involves the problem of the context.

Assessing the impact of using steel in the manufacturing of trains is not only a question of the efficiency with which a given manufacturer produces the trains. The context in which this production process is embedded is of crucial importance for the amount of environmental impact generated. If the foundry is supplied with electricity made by a power plant using ‘brown coal’ (lignite), the impact of using 1 kJ is much higher than when using electricity from a coal-fired power plant. Even lower impacts come from contexts in which electricity is co-generated with heat used for district heating systems. And what if the electricity is provided by the extensive use of windmills or water power? In all these instances the air pollution that the foundry’s use of 1 kJ has to account for is widely different, even though the foundry itself is precisely the same!

The problem of the context also gives rise to another problem, namely, when to stop the calculations—to stop the tracing of impacts in different branches of the products life cycle. The phrase itself, ‘life cycle assessment’, signals that you have to go from cradle to grave. In fact, this is often too huge and too difficult a task. Normally you define some ‘boundaries’ of the system that allow you to compare the different products or services, i.e. that the impacts generated outside the boundaries are either negligible or of a similar amount. Where to ‘carve out’ the system in question, of the context it is embedded in, is always dependent on the scope of the investigation and / or the nature of the system under consideration.

Last, but not least, another group of problems arises when it comes to delineating the different types of environmental impacts which should be taken into consideration and how to compare these often widely differing impacts. The concept itself, environmental impacts, signifies a simple relationship between cause and effects. But in effect the environment is a wide array of different impacts. The impact of a process can be multifaceted, including dimensions such as impact on a material cycle concomitant with impacts on the use of space (affecting habitat and species diversity), and the impact on health. All these dimensions can be subdivided into endless lists of impacts. This is, of course, not manageable, so we have to make some more clear-cut dimensions. Consensus has recently been reached, at least to a certain degree, on how to group different impacts in broader categories. These are greenhouse, ozone layer and acidification for air pollution, and eutrophication for water pollution. The use of non-renewable raw materials and the impacts on human health divided into toxicity and carcinogenity are other categories.

The division of environmental impacts into subdivisions of calculations is also the answer to another problem, namely how to compare the different impacts. Often it is assumed that it is acceptable to translate widely different qualities, i.e. impacts, to one single common denominator. This procedure is, for example, widely used in cost–benefit analysis where the common denominator is money. Many scientists would elaborate on the same type of solution and philosophy when it comes to the wide variety of environmental impacts. Many, however, also reject the whole idea that one type of problem—impacts such as carcinogenity—can be translated to (i.e. compared with) another problem such as rising levels of carbon dioxide in the atmosphere. This is also the reason why impacts are divided in larger groups, because we can to a certain degree translate the effect of carbon dioxide and other greenhouse gases to each other, but it is impossible to compare greenhouse effects with eutrophication.

RESULTS OF THE INVESTIGATION

We now present some of the preliminary results of our investigation. Until now we have focused on establishing the impacts of some of the dimensions which we assume have the largest environmental impacts. Furthermore, the impacts are not yet seen in their totality, but we have only concentrated on air pollution (greenhouse gases and acidification). This means that the analysis is incomplete. It will take a lot more time and energy to complete the study, so that, for example, the use of different energy consuming equipment in the household (freezers, refrigerators, washing machines, etc.) is included, not to mention how to account for the variety of environmental impacts they cause. However, as the numbers in the tables reveal, new information such as this might give more precise quantities, but it will not significantly change the overall relationship between the impacts from the different components of the lifestyles.

The results from our analysis of the four different lifestyles are presented in Tables 1–3. As seen from the tables, the four lifestyles have widely different impacts on the environment. The use of primary energy, which is equivalent to fossil fuel, ranges from 44,000 to 372,000 MJ / yr. The most ‘resource consuming’ family uses more than eight times the amount of energy that the most green and ecologically minded family does. The impacts on the

Table 1. The use of primary energy in MJ per year for the different families

	A	B	C	D
Housing	6876	6876	7984	16,137
Heating	87,665	82,375	75,567	23,232
Electricity supply	50,054	20,002	19,013	339
Transportation	219,760	83,098	7309	688
Provisions	8330	7014	5439	3913
Total	372,685	199,365	115,312	44,309

Table 2. Carbon dioxide emissions in kg per year for the different families

	A	B	C	D
Housing	378	378	391	924
Heating	6031	8665	7950	2620
Electricity supply	4997	1886	1794	0
Transportation	18,960	7110	480	0
Provisions	654	547	514	368
Total	31,020	18,586	11,129	3912

Table 3. Sulphur dioxide emissions in kg per year for the different families

	A	B	C	D
Housing	2	2	2	4
Heating	11	4	4	1
Electricity supply	2	1	1	0
Transportation	11	4	1	0
Provisions	1	1	0	0
Total	27	12	8	5

carbon dioxide balance are primarily caused by the combustion of fossil fuels and the differences in impacts thus mirror the use of these non-renewable resources. When it comes to acidification, here measured as potential emissions of sulphur dioxide, the difference is not so large: only five times larger in the most polluting family as in the least polluting. The reason for this is mainly that some of the more resource-consuming heating systems in fact use fuel with a low content of sulphur.

We have reason to believe that the four components of lifestyle which we have analysed (housing, energy supply, transportation and provisions) are the most important. The use of different machines (washing machines, refrigerators, etc.) also plays a part, but their operation (energy use) is probably far more important than their construction and final disposal, and these operational costs are already included in the energy budget of the household in question. We think that leisure and vacation activities are additional areas of interest that should be included in a future extension of the account for these environmental impacts.

The four main areas or components of a lifestyle that we have analysed all show very large differences in environmental impacts. Some of the components of lifestyle can be influenced by a family when it makes a decision on how to live (housing), how to be transported and which types of food to eat, but in other cases the infrastructures that we all are embedded in to a certain extent makes some of the decisions for us. Let us briefly discuss the four components of lifestyle.

Housing constitutes less than 2% of the use of primary energy in the most polluting family (A), but 36% in the family with the green lifestyle (D). The reason for this difference is twofold. First of all the more environmental friendly ‘low-energy’ house costs much more energy and resources to construct and maintain—more than twice the resources used for an ordinary house. This investment is not necessarily environmentally unsound, but must be seen in conjunction with the much lower energy consumption in the 80 years the house will be ‘operated’ by family D. In fact, the larger ‘investment’ in the house is, measured in energy, paid back in a few months. The other reason why housing seems to be one of the most important factors in the ‘green lifestyle’ family (D) is that the total amount of environmental impacts are much lower than in the other families, and the percentage then naturally becomes larger.

The supply of heating and electricity for the household constitutes between 37% in family A and 53% in family D, but this difference is primarily caused by the fact that family A has a far larger environmental impact than family D. In fact, family A uses 137,719 MJ/yr for energy supply, whereas family D only uses 23,571 MJ/yr. In other words, family A uses more than five times as many resources to provide heating and electricity and causes four times as many negative impacts on the carbon dioxide balance as family D. The procurement of heating and electricity can be influenced by personal choices when it comes to the type of house, type of machinery, electric light bulbs and so on, but the environmental impacts are also to a certain extent influenced by the infrastructure of society. Not all people have the opportunity (and money) to buy a low-energy house. In Denmark most people are supplied with heat and electricity through larger systems that deliver heat (district heating) and electricity. In this case the environmental impacts they have to account for are widely influenced by how these systems are constructed and operated. This is clearly seen when comparing families A and B. Family A have a traditional house not connected to a district heating system. The energy use is almost the same for heating, but widely different for electricity. The reason for this difference is that the electricity produced in a traditional power plant has a very low efficiency compared with the total amount of energy used. Contrary to this, the co-generation of electricity and heat are much more efficient, so family B’s use of electricity does not have the same negative impact on the environment, although they use the same amount of electricity as family A. In that sense a certain amount of environmental impact must be attributed to infrastructure (Jänicke *et al*., 1989). The effects of this could be much greater if the systems used more environmentally friendly fuels such as natural gas, biogas, wood or other renewable resources.

Transportation is the component of lifestyle with the widest differences in environmental impact. The impacts range from almost nothing to almost 220,000 MJ/yr in the ‘American lifestyle’ family (A). In this sense the family which relies most on car transportation uses five times as many resources on this activity than the ‘green lifestyle’ family uses all. Of course, we must admit that the scenario for family D is highly unlikely. It might be correct that they live within cycling distance of their workplace, but it is highly unlikely that they do not use trains or buses for some activities, for example, when shopping or during the winter. But as family C clearly demonstrates, even the extensive use of public transportation (in this case train rides) does not cause environmental impacts that exceed more than a few per cent of the impacts caused by the families heavily dependent on excessive car transportation. Transportation by car must be seen as the most important single factor in the creation of non-sustainable lifestyles. As is clearly demonstrated, people are, in principle, able to influence their use of transportation. However, we must not forget that these choices are more or less directly influenced by the 'physical planning' of our societies, where we often find a functional zoning between living quarters, workplaces, leisure activities and shopping centres. This zoning, or fragmentation of our daily lives, often establishes private transportation in cars as a necessity.

Provisions range from almost 9% of the resource consumption in family D to slightly above 2% in family A. In fact, family A, who eat a lot of meat and traditionally produced agricultural products, use twice as many resources for this purpose as the green lifestyle family. Two tendencies are of wider interest. First of all it is clearly demonstrated that organically produced goods have a much lower impact on the environment than traditionally grown and produced products. This can be seen when comparing families B and C. Generally speaking, a transition from traditional agricultural products to organic products will decrease the environmental impact by about 20%. Another tendency is also conspicuous, namely the positive environmental effects associated with a switch from meat products to vegetables and grain products. As a comparison of families A and B and families C and D, respectively, clearly demonstrates, the environmental impacts from the provision of foodstuffs would further decrease by 16–28% if we made such a modest transition in our diet. Not to be vegetarians, but just to have a healthier diet with more fibre and carbohydrates and less fat. In fact, this is just a return to eating habits as we knew them a few decades ago.

CONCLUSIONS

These preliminary results clearly show that families influence our environment very differently. Some contribute heavily to our pollution problems and the use of non-renewable resources, whereas other families have a more modest negative impact on the environment.

Sustainability has recently gained popularity in wider parts of the Western world and many activities are going on to try to change the rather grim-looking future of our planet. In industry we have seen a tendency to become 'green' (Fischer and Schot, 1993) and public authorities are also trying to think and act in accordance with broader measures of sustainability (Ward, 1993). All these activities have hitherto been focused on the environmental impacts of production processes, products and public planning and the provision of infrastructures, topics that ordinary people often have no or only a negligible impact on. At the same time it is constantly emphasized that people should 'think global, act local'. We feel that a broadening of the perspective is now necessary, so that discussions of lifestyle and consumption patterns are initiated, not to moralize about the depraved lifestyles of modern people, but rather to inform about possible lines of action. In the longer term this will help to initiate discussions of how to produce infrastructures, attitudes, legal and economic incentives that together can further the necessary transformation to a more sustainable society.

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BIOGRAPHY

Per Christensen, Aalborg University, Department of Planning and Development, Fibigerstraede 13, 9220 Aalborg, Denmark