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Life Cycle Assessment of Noise Emissions: Comment on a Recent Publication

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In a recent paper Ongel [1] presents a method to include the environmental effects of noise in life cycle assessment (LCA) studies of road transportation. Noise assessments have been developed for decades, but inclusion of noise impacts in LCA has been conspicuously missing for a long time [2]. Müller-Wenk [3] proposed a method for the inclusion of road traffic noise in an LCA, but this method was limited in so far that it could only account for noise by transport, while clearly other sources of noise are important as well [4]. To develop an approach that is more widely applicable, Cucurachi et al. [5] extended the general principles for modelling environmental impacts with special attention to the additivity over the processes that make up a life cycle. This additivity principle is the basis underlying any life cycle impact assessment (LCIA) system, and without it, no life cycle-wide assessment is possible. We do not claim that our work and its further elaboration in Cucurachi and Heijungs [6] are perfect, and we welcome Ongel's [1] remark that our "method does not allow comparison of health impacts of noise with those of other environmental interventions", because that was admittedly one of the weaker points in our work (we mentioned, inter alia, the problematic model assumption of non-linearity). The reason is that our approach ends with an impact indicator in person × Pascal × seconds, while the impact indicator for greenhouse gases is kilograms CO_2-equivalent, which are indeed incomparable. Extension to so-called endpoints (here: human health, expressed in disability-adjusted life years) is only cursory addressed, and any effort to improve is considered with an open mind.

However, we disagree with the subsequent remark that our method works "without considering any specific functional unit or life cycle". As a matter of fact, the term "functional unit" occurs seven times in Cucurachi and Heijungs [6], and it forms an essential element of our method, as is clear from our critique on earlier methods which lost "the focal point that noise effects in LCA need to relate to the functional unit" [5]. Our previously mentioned difficulty in assessing the endpoint impact of human health, by the way, is to some extent related to this issue with the functional unit. While it is relatively easy to observe noise-related incidence cases (deafness, hypertension, etc.) as well as sound levels at the place of exposure, such evidence-based cases are hard to relate to individual sound sources in a life cycle. The main contribution of Cucurachi et al. [5] is to construct a mathematical model to aggregate sound emissions across the life cycle of a product. This requires going back from the impact to the sources, calculating a linear indicator of sound emissions, and developing an impact model which can work with these linearized sound emissions. In trying to make a step further, in fact, Ongel [1] makes a step back: she observes sound levels at the place of sound exposure. In doing so, the author herself seems to forget the life cycle in the illustrative case study that is included by Ongel [1]: "The study included 70-km length of the main arterial roads from the municipalities in the Western, namely the European, part of Istanbul.... Traffic data in terms of annual average hourly traffic volume, speed, and traffic

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composition for the year 2010 were obtained from 21 loop detectors located along these arterial roads". Clearly, this is a site-specific noise assessment, targeted at assessing the situation in a specific part of Istanbul. It is very useful, but it is not LCA, precisely because the life cycle perspective is missing. A true LCA would not only look at the noise made by traffic, but also at the noise during raw materials mining, vehicle production and maintenance, disposal, etc. Perhaps the approach of Ongel [1] is innovative, and perhaps it is applicable to LCA. However, by not demonstrating that it is applicable to LCA, it fails to convince us of a method that could be applied to LCA, while its purpose was explicitly "to illustrate the applicability of the proposed LCA method using a case study".

For an LCA of, say, refrigerators, the approach of Ongel [1] will necessarily break down. Sound emissions from the life cycle of a refrigerator occur partly at a road, during the transport of the refrigerator and more upstream the transport of its components and materials. But it is essential to calculate the share of these transport activities in the total transport scenario characterizing the road. That is the heart of LCA: allocating total emission levels to the product under study. Impact models, such as Ongel's, that do not take this peculiarity into consideration will be inapplicable to LCA in the end.

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