Aesthetic design for minimum weight: new approaches for sustainable vehicle development

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The transport sector is one of the major originators of climate relevant emissions: Still depending on oil by 98% this sector dissipates 30% of the energy totally consumed in the EU and also causes almost one third of CO2 emissions [1]. However, already by 2020 another demand growth of around 32% in passenger kilometres and 69% in tonne kilometres for freight is anticipated (EU figures only.) Against this background, mitigating negative impacts is an ambitious challenge as the increasing use of the road system has the potential to negate technical improvements in all relevant fields [2], [3]. To counteract this, further significant research efforts are required.

In this context, a better coordination of aesthetic design and engineering promises access to so far unconsidered energy saving potential -notably in the field of lightweight vehicle design. Here, exploration of transdisciplinary synergies can further reduce accelerated mass and therewith contribute directly to fuel savings. However, to develop ultra-lightweight vehicle structures with high aesthetic appeal modifications of the established development processes are necessary, particularly in the preliminary design phase (phase of topology and layout definition.) Besides adequate material selection, lightweight design primarily requires the development of favourable spatial load paths. Due to the inherent complexity, very sophisticated methodologies and state-of-the-art computational tools are required to reach true minimum weight as close as possible.

Current research at the Department of Vehicle Design at the Royal College of Art, London UK investigates the conflict of objectives at the interface of aesthetic design and engineering with focus on vehicle design processes targeting the development of dedicated methods and tools for the domain. This contribution depicts first research results of the project: Starting from a review of the state-of-theart in lightweight engineering and manufacturing, new approaches for transdisciplinary structural form-finding processes are presented. Concluding, an outlook on future research activities is given.