Autonomous Driving

Technical, Legal and Social Aspects
Society and Mobility

As by clear evidence: We are on the brink of the next mobile revolution. Autonomous vehicles will become an element of road traffic. The data needed is provided by cameras and sensors, and processed in real time by a computer in fractions of a second. These vehicles permanently exchange information with one another and with the transport infrastructure. Driving robots are to successively relieve the driver of individual tasks.

Nonetheless, the technological perspective of autonomous driving is only one aspect of many. Autonomous vehicles will also have a direct impact on our society that today we can barely imagine. Numerous critical questions arise: What are the prospects concerning data security? How shall we deal with wide-ranging interventions in our own mobile autonomy? What problems result when an autonomous vehicle crosses national borders? In what form will insurance companies assume liability for autonomous vehicles involved in accidents in the future? Or, vice versa: Can we continue to leave humans at the wheel at all, and may driving robots prove to increase road safety?

The Daimler and Benz Foundation considers the social dimension of these changes to be of at least as great significance as the technological one. Innovative technologies are by themselves insufficient to shape these developments and to realize automated driving in our society. We are therefore well advised to already start asking ourselves such questions today and not simply accept this profound change in our mobility as given, allowing it to “overrun” us. To shed light on the ethical, social, legal, psychological, or transport-related aspects of this process, the Daimler and Benz Foundation invited researchers from various specialist fields to address this topic.

The project’s core team—Markus Maurer, Barbara Lenz, Hermann Winner, and J. Christian Gerdes—identified the most pertinent questions from their point of view. At the same time, the four researchers established an international network of renowned specialists, who agreed to share their views and experience. The result before us now, a
“white paper”, analyzes the developments that can already be seen from an interdisciplinary perspective. It is the preliminary result of a large-scale funded project: Under the name “Autonomous Driving—Villa Ladenburg”, it was given a time frame of around two years and a budget of 1.5 million euros by the Daimler and Benz Foundation. Our declared aim with the present findings is to make available an objective and independent source of information.

To our minds, exploring the topic from an interdisciplinary perspective is indispensable. In the present volume, the authors therefore attempt an initial comprehensive account of what we may judge as scientifically assertable at this moment in time. At the same time, we must enable potential users of, and others affected by, the still difficult-to-grasp new technologies to experience them firsthand. In this way, many people can begin to have an idea of what they can expect and what the technology can actually do—and also what it will not be able to do.

It is already becoming clear that three aspects come to the fore. Firstly, ethical questions will override all others. Only when autonomously acting vehicles have successfully been provided with a kind of ethics in decision making will driving robotics be able to assert itself in practice. This is especially true of so-called dilemma situations, in which it has to be weighed up, in the case of an unavoidable collision, what behavior will cause the least amount of harm to the persons involved both inside and outside the vehicle. A further key question to clear up is what legislative consequences could result here (e.g., traffic regulations).

A further matter concerns the performance of machine perception. This comes up against various limits: Sensors, cameras, or assembled components degenerate and suffer in their reliability over time. Although it is possible to estimate state uncertainties, and from this to check machine-perception performance, will failures really be predictable? And how could an autonomous machine’s safe state be at all defined under all conceivable circumstances? This issue can be summed up even more clearly in one keyword: robotification. Ultimately, the specific questions addressed here without exception penetrate in deeper forms into all areas of everyday life where autonomous machine systems are used. Conditions here also need analyzing, and consequences must be anticipated.

Not least, automated driving can open up completely new opportunities, but also bring with it negative aftereffects. A reduction or shifting of parking-space requirements in inner cities and an efficient use of road space in flowing traffic would be set against fresh suburbanization stemming from alleviated conditions on the urban fringe.

As befits our Foundation’s purpose, this publication is designed to contribute to the anticipation and excitement of future discourse, and in this way is aimed at benefiting society as a whole. The book will place a scientific basis in the hands of representatives
from politics, science, the media, academia, and the interested public. This provides the necessary foundation for an independent and capable examination of the diverse questions and conditions of autonomous driving.

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