

# **Automation spectrum, inner / outer compatibility and other potentially useful human factors concepts for assistance and automation**

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## **Abstract**

Enabled by scientific, technological and societal progress, and pulled by human demands, more and more aspects of our life can be assisted or automated. One example is the transportation domain, where in the sky commercial aircraft are highly automated, and on the roads a gradual revolution takes place towards assisted, highly automated or fully automated cars and trucks.

Assistance and automation can have benefits such as higher safety, lower workload, or a fascination of use. Assistance and automation can also come with downsides, especially regarding the interplay between human and technology (e.g., Bainbridge, 1983; Billings, 1997; Norman, 1990; Sarter & Woods, 1995a). In parallel to the technological progress, the science of human factors has to be continuously developed such that it can help to handle the technological complexity without adding new complexity (e.g., Hollnagel, 2007).

In this overview article, some fundamental human factors issues for assistance and automation that the authors found useful in their daily work are briefly sketched. Some examples are described how those concepts could be used in the development of assistance and automation systems. While the article deals especially with assistance and automation in vehicles, the underlying concepts might also be useful in other domains.

## **From levels of automation to automation spectrum**

Sometimes the terms “assistance” and “automation” are used as if they are clearly distinct or even opposite poles. In addition, some technologically brilliant developments (Dickmanns, 2002; Parent, 2007; Thrun et al., 2006) might suggest that fully automated vehicles are the “natural” follower of manually controlled vehicles and the unavoidable future. The challenge of automation is more complex, there might be solutions between assistance and automation. Which concepts could help to structure the discussion about automation issues?

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