1 Motivation
Increasing Grades of Automation (GoA) alter the remaining tasks of the train driver. Assisted by GoA1 systems, the driver is prevented from excessive speeds. GoA2 systems take over the speed control, while the driver is continuously monitoring the train ride in the cabin. GoA3 and 4 systems “drive” unattended trains without a driver on-board (GoA3 includes on-board service staff, while GoA4 means completely unstaffed trains).

2 Methodology
In a first step, an expert panel (n= 4) from Human Factors and railway operation extracted a complete set of obligatory tasks from the regulations underlying today mainline service in Germany. In consecutive steps, these tasks were allocated to the domain of one of three actors: the automation, the train operator, or costumer service staff on-board. The tasks were allocated based on majority opinion within the expert panel to derive a first set of tasks to be performed by the train operator.

3 Results
The extracted set of tasks resulting from the first methodological step included 79 distinct tasks that are currently executed by the train driver according to the regulation. These tasks were then allocated to the three actors in question (automation = 47 tasks; train operator = 24 tasks; costumer service staff = 8 tasks) and aggregated into categories. Figure 3 depicts the current categories of tasks of a German train driver (GoA1), while Figure 4 shows the assigned categories for the TO (GoA3).

4 Conclusion & Further Work
Changes in task allocation due to increased GoAs shape a TO role characterised by situation assessment and coordination in case of non-routine events. A prototypical workplace has been set up to quantitatively compare performance, fatigue and situation awareness of the TO with train drivers in lower GoA environments. By the TO notion, we can further investigate the human contributions to automated railway resilience.

5 References