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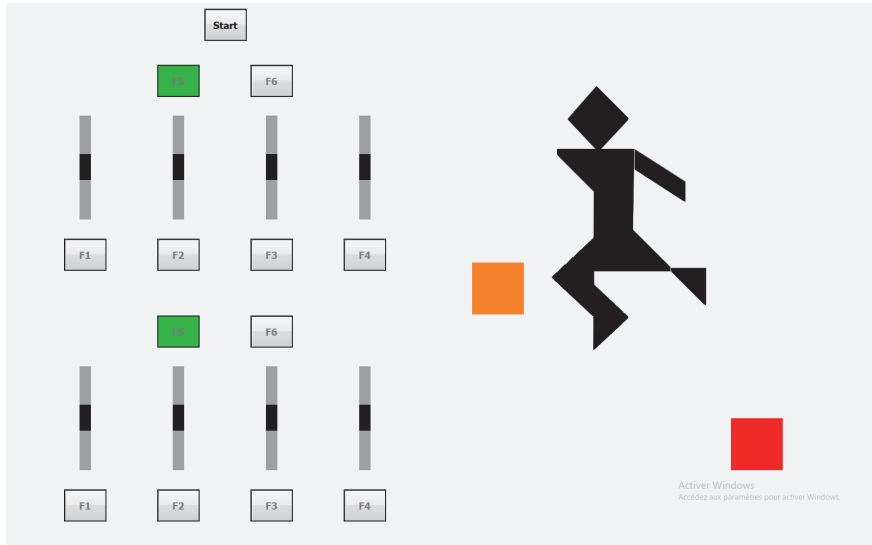
# **Automation Challenges of Socio-technical Systems**

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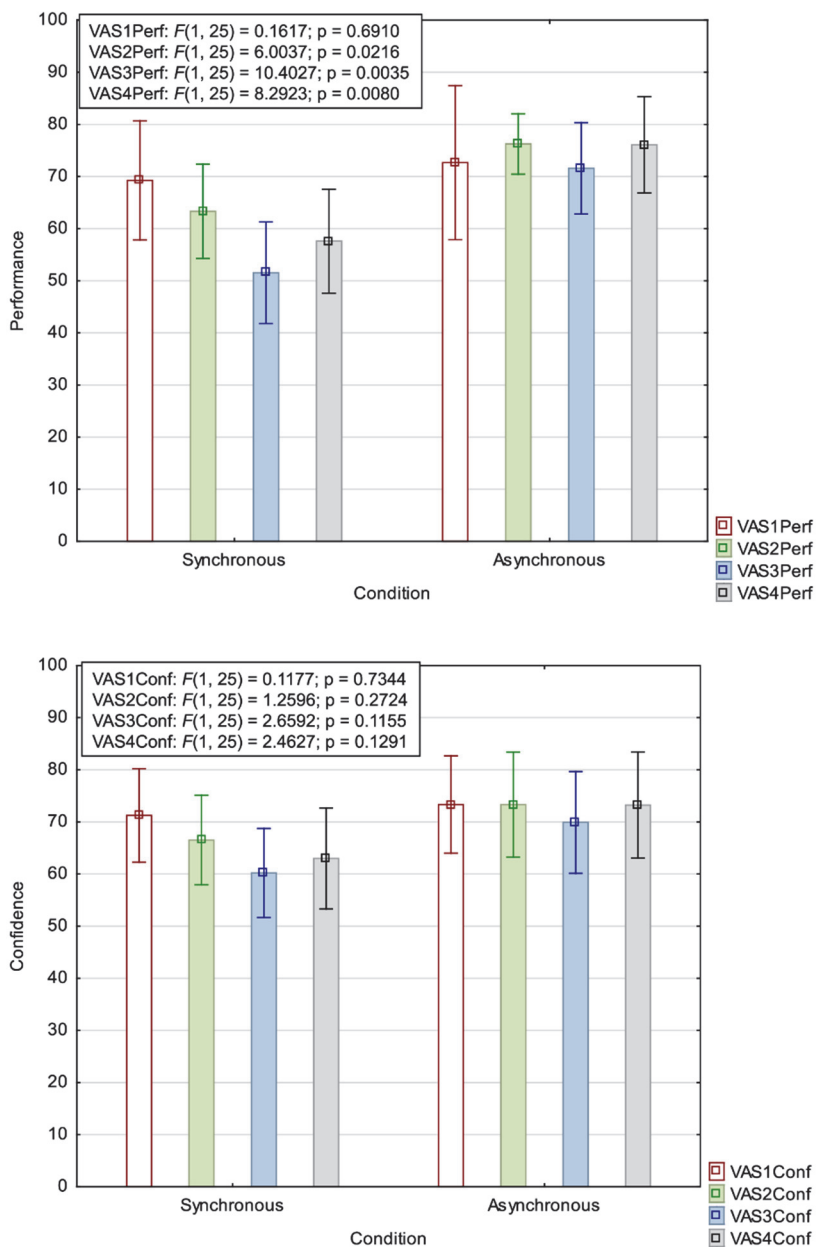
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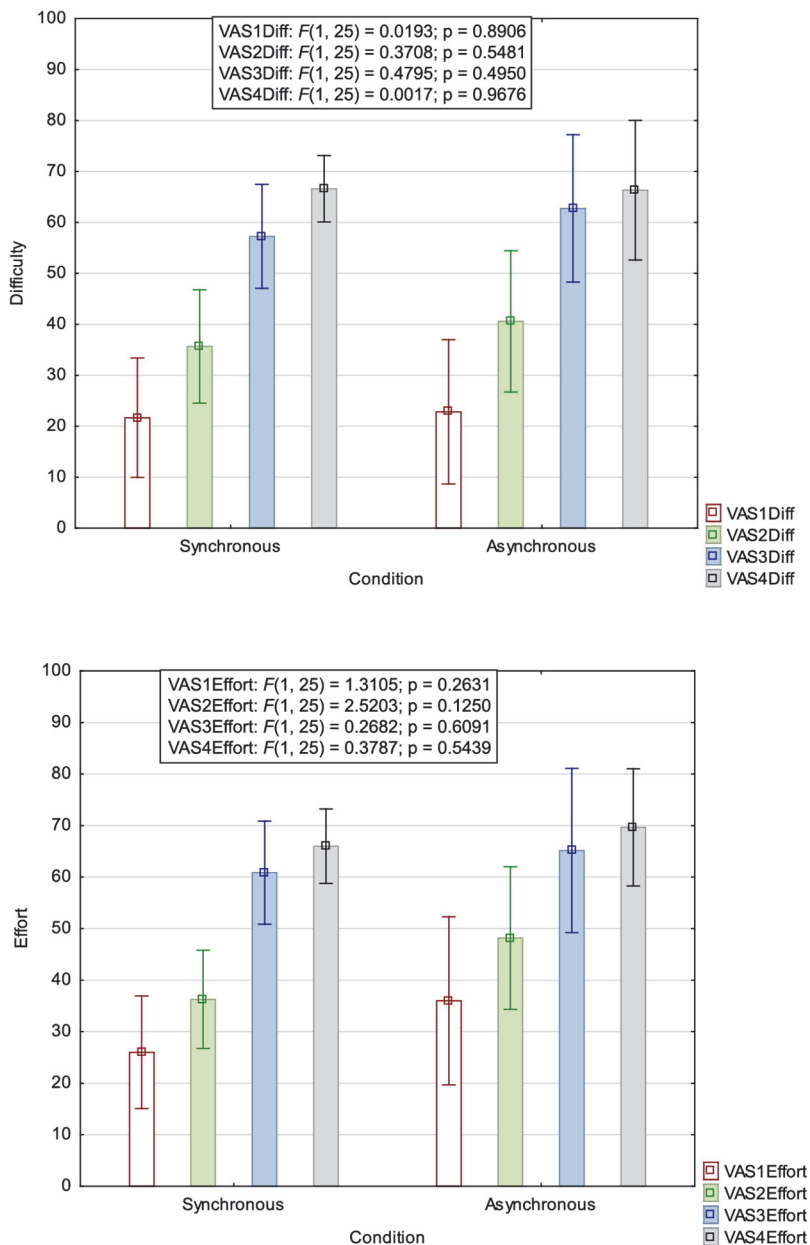
Color section



**Figure 1.1.** *Screen display of levels 3 and 4 and appearance of the visual and auditory alarms (two red and amber squares)*

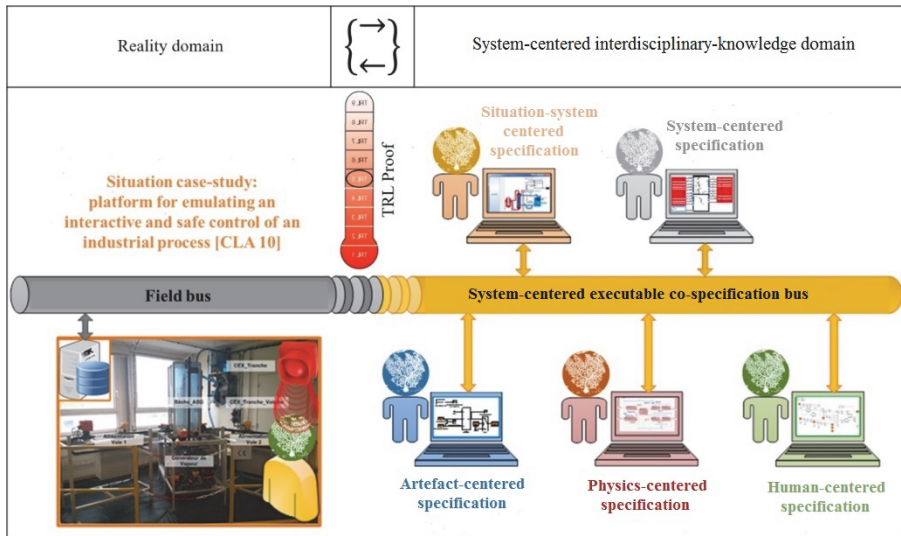


**Figure 1.7a.** Evaluation of the dimensions (VAS out of 100) as a function of the condition and for each level of mental demand

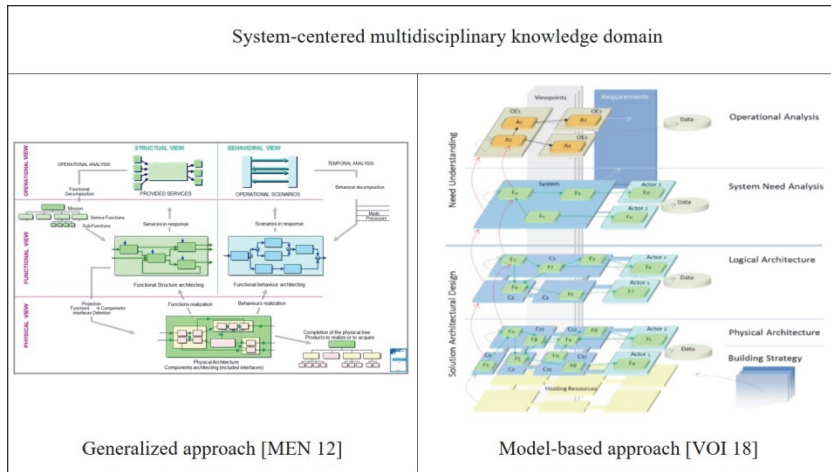


**Figure 1.7b.** Evaluation of the dimensions (VAS out of 100) as a function of the condition and for each level of mental demand (follows previous)

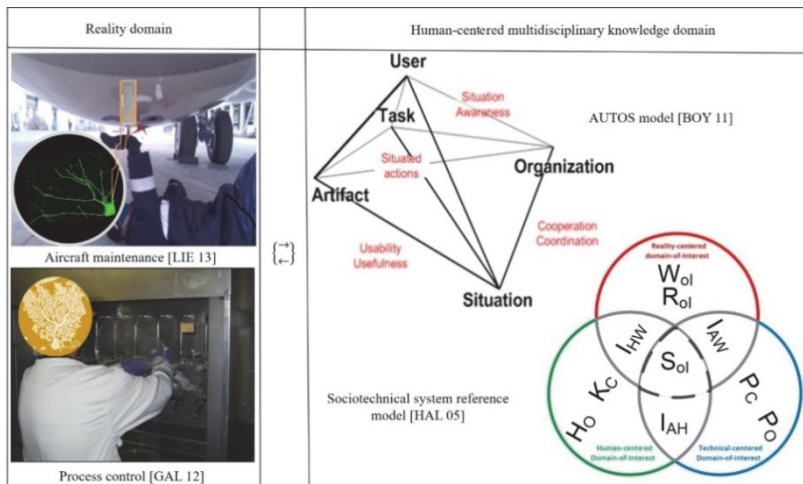




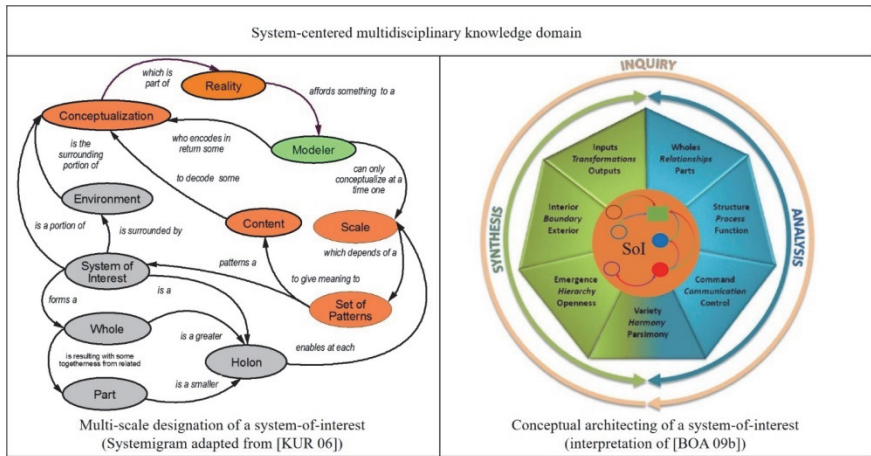
**Figure 2.1.** System context of the model-based interdisciplinary specification of the targeted physico–physiological interaction of sensory perception studied [BOU 16]



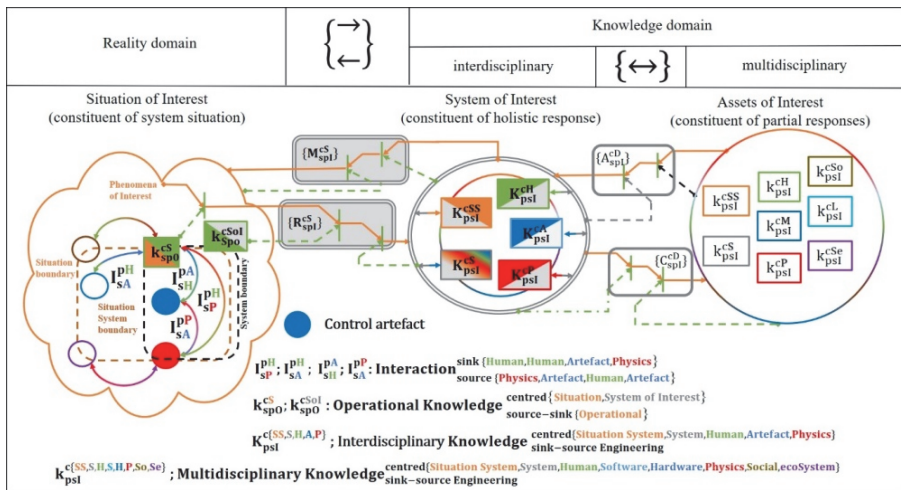
**Figure 2.3.** *Coupling relations between systems architecting levels*



**Figure 2.4.** *Operational situations of multidisciplinary specification of sensory perception interaction*



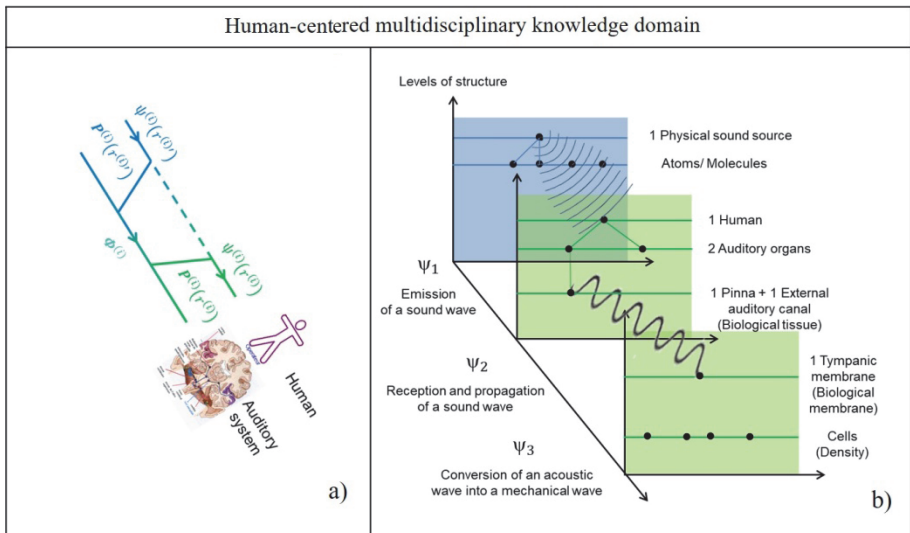
**Figure 2.5.** System-thinking for system-centering the architecture



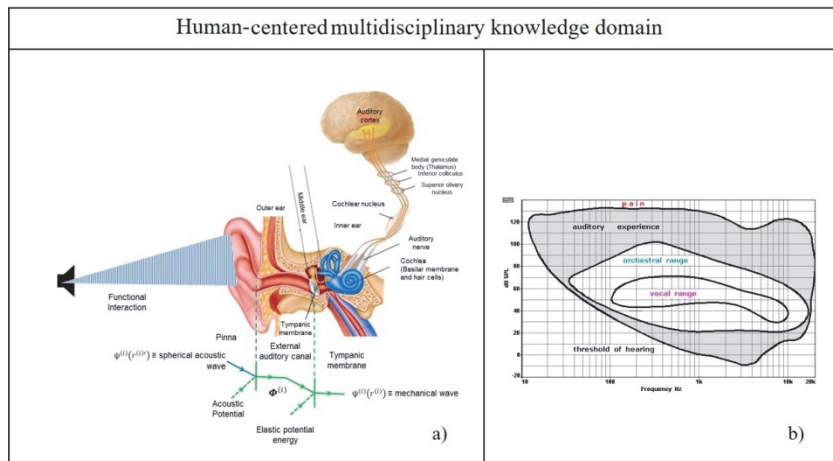
**Figure 2.6.** Cognitive and specifying interpretation of the coupling diagram

**Figure 2.7.** Causal loop diagram of the targeted control situation

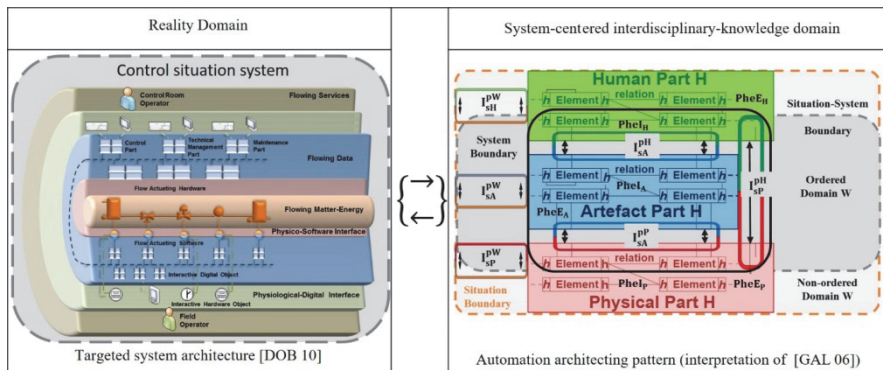
**Figure 2.8.** Stock-flow diagram of the targeted control situation system



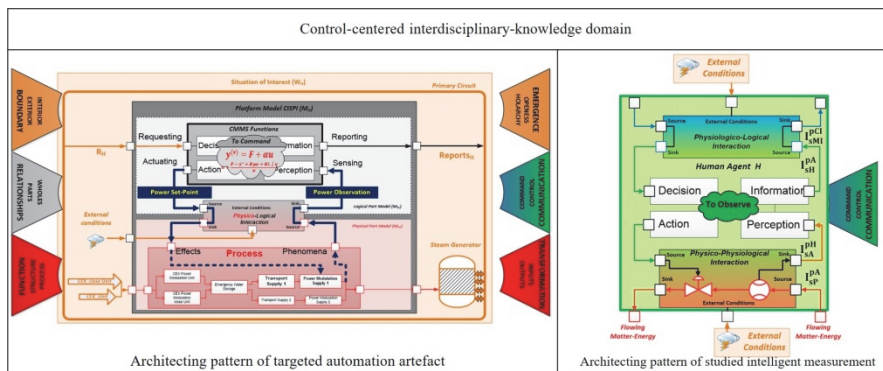
**Figure 2.13.** *Elements of understanding of the operational interaction of targeted auditory perception*



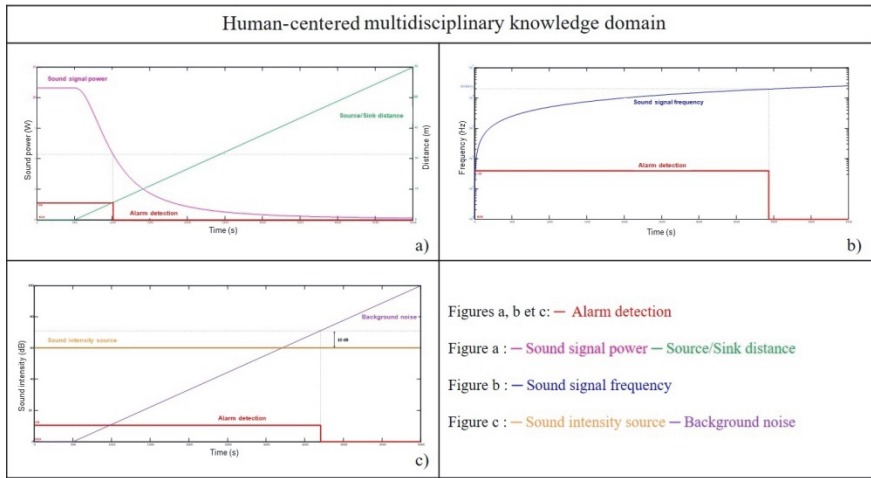
**Figure 2.14.** *Elements of understanding that center the interaction of sound sensing in the human auditory domain [BEA 96, GAZ 00]*



**Figure 2.16.** Situation system-centered architecting specification of an interactive-aided control system



**Figure 2.17.** Control-centered architecting specification refinements

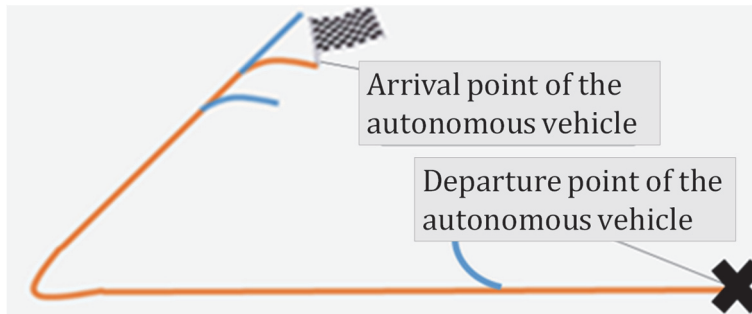


**Figure 2.19.** *Scenarios of testing “human-centered intelligent measurement”*

System-centered interdisciplinary-knowledge domain			
Scenario 1		Scenario 2	
Initial conditions		Initial conditions	
Technical alarm distance {Source} / Human agent {Sink} = 5 meters	Density of air {Temperature = 20 °C} = 1.2 kg/m <sup>3</sup>	Technical alarm distance {Source} / Human agent {Sink} = 5 meters	Density of air {Temperature = 20 °C} = 1.2 kg/m <sup>3</sup>
Celerity of sound = 331.5 m/s	Background noise = 90 dB	Celerity of sound = 331.5 m/s	Background noise = 90 dB
<b>Alarm power = 0.7 W</b>	Alarm frequency = 20 Hz	<b>Alarm power= 1.2 W</b>	Alarm frequency = 20 Hz

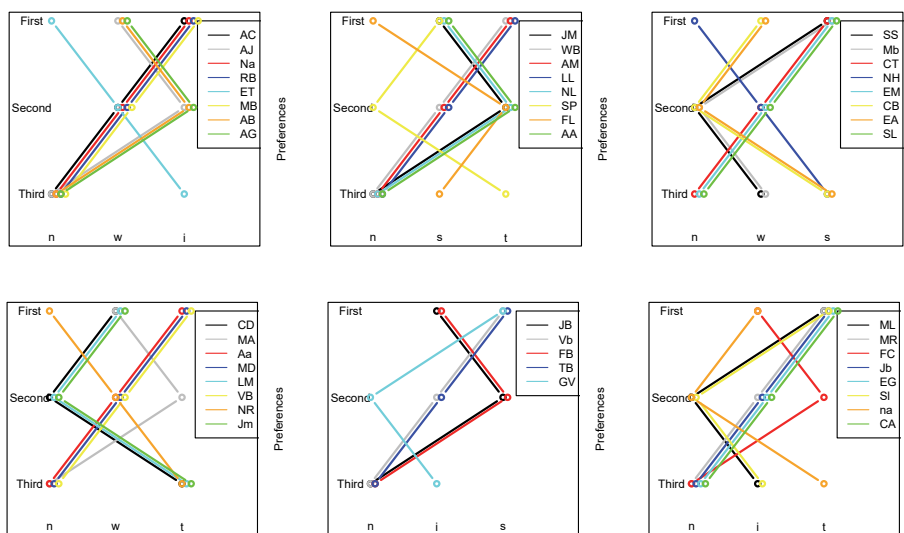
**Figure 2.21.** *Trace of execution of the scenarios of system validation in silico of the executable specification of the targeted auditory interaction*



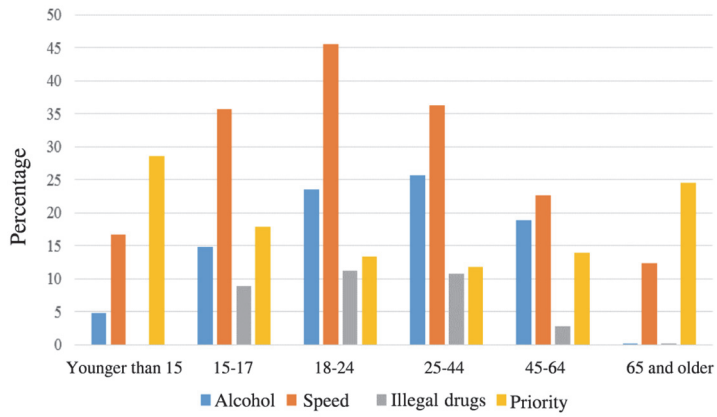


**Figure 4.6.** Terrain used during the simulation. The journey in orange is the one that is effectively taken by the autonomous car in the simulation

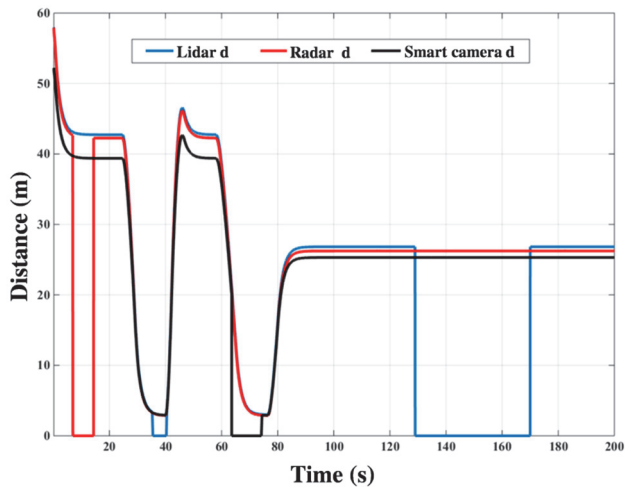




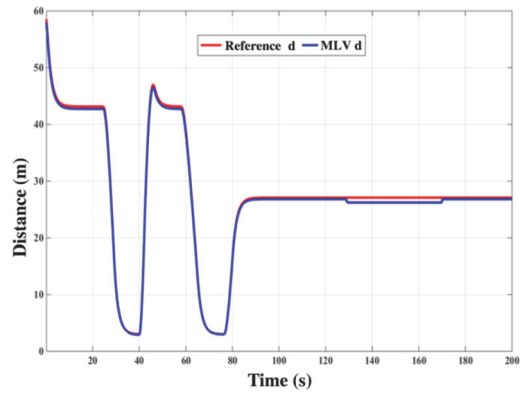
**Figure 4.8.** *Ranking of the I interfaces by each participant*



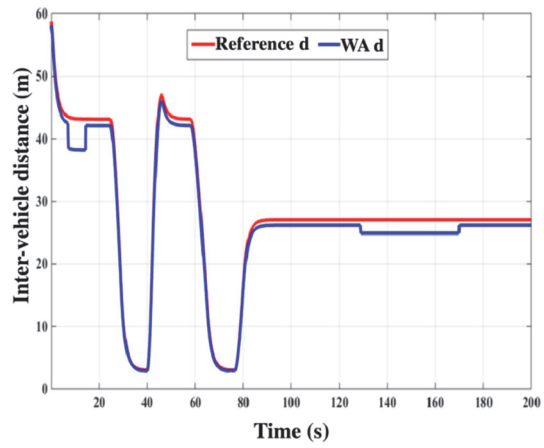
**Figure 5.1.** Statistics on causes of accidents by age group (source: ONSIR)



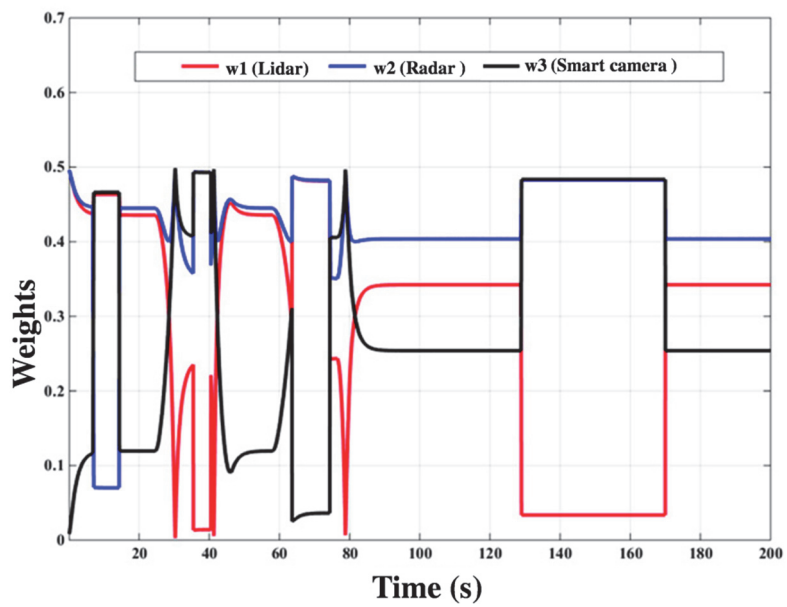
**Figure 5.9.** Fault emulation on different sensor measurements



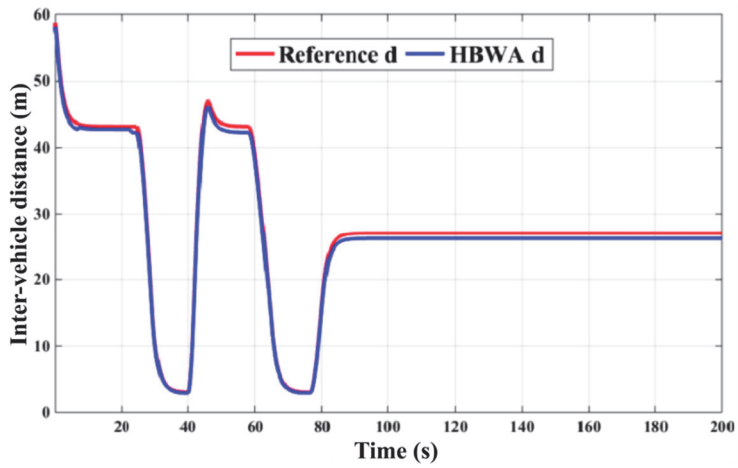
**Figure 5.11.** *Inter-vehicle distance using the maximum likelihood voting (MLV) algorithm*



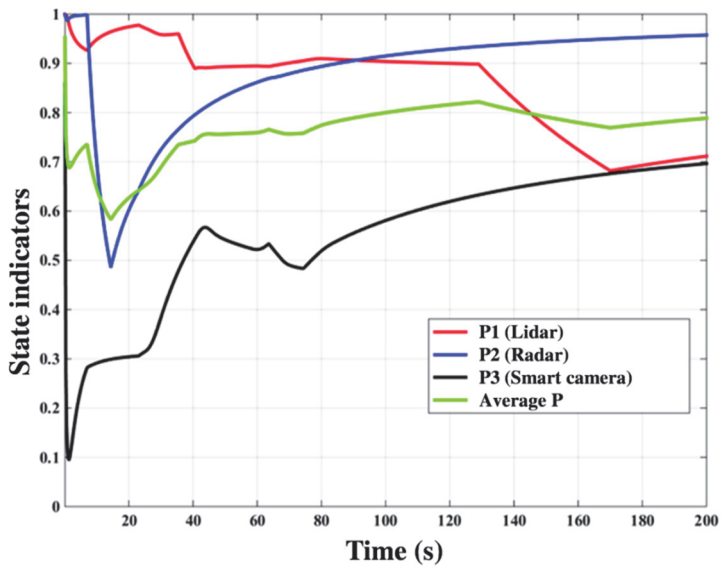
**Figure 5.13.** *Inter-vehicle distance using the weighted averages (WA) algorithm*



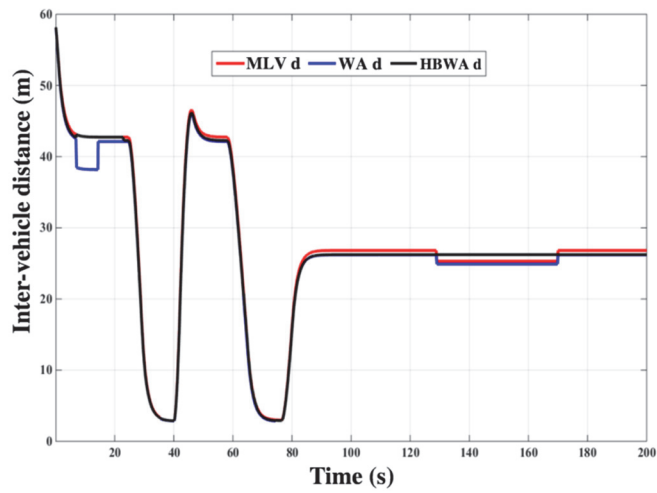
**Figure 5.14.** *Weights of the weighted averages (WA) algorithm*



**Figure 5.15.** *Inter-vehicle distance using the history-based weighted average (HBWA) algorithm*



**Figure 5.16.** *Evolution of state indicators (HBWA)*



**Figure 5.17.** Comparison of inter-vehicle distance using the three algorithms

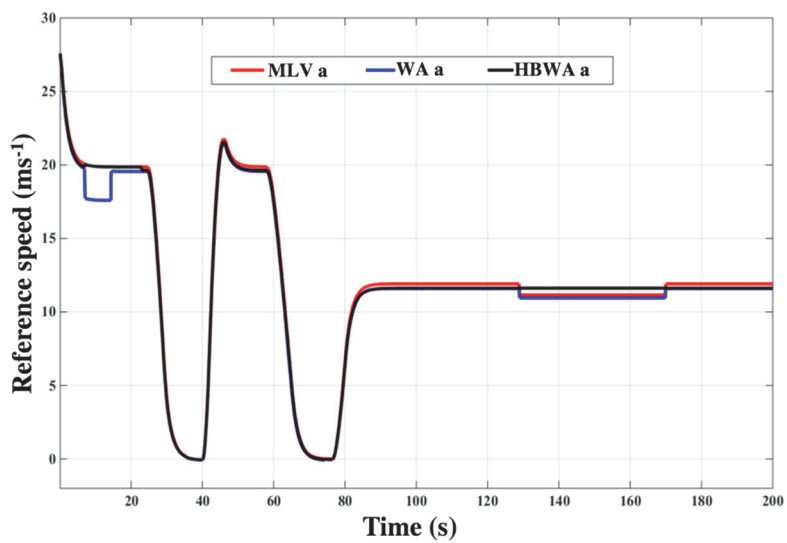


Figure 5.18. Reference speed comparison

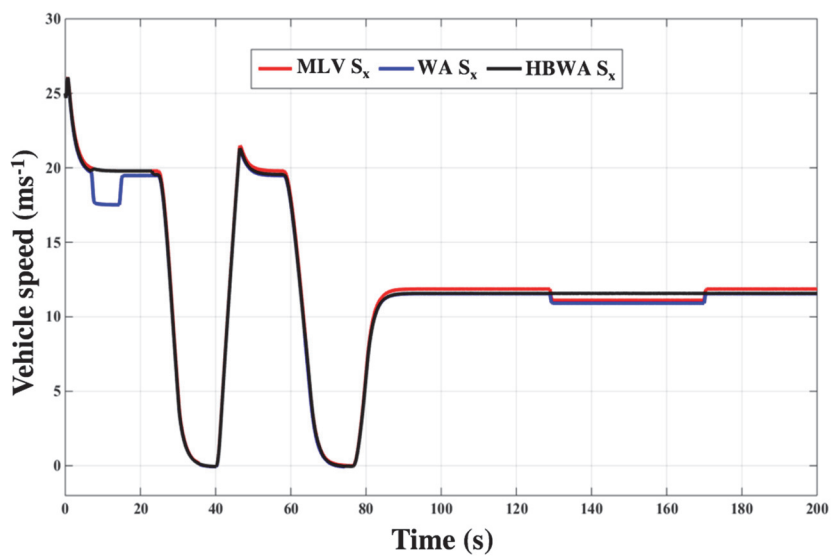
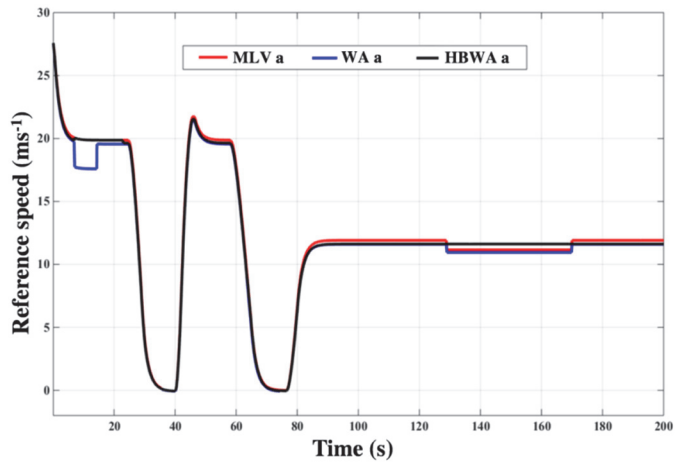
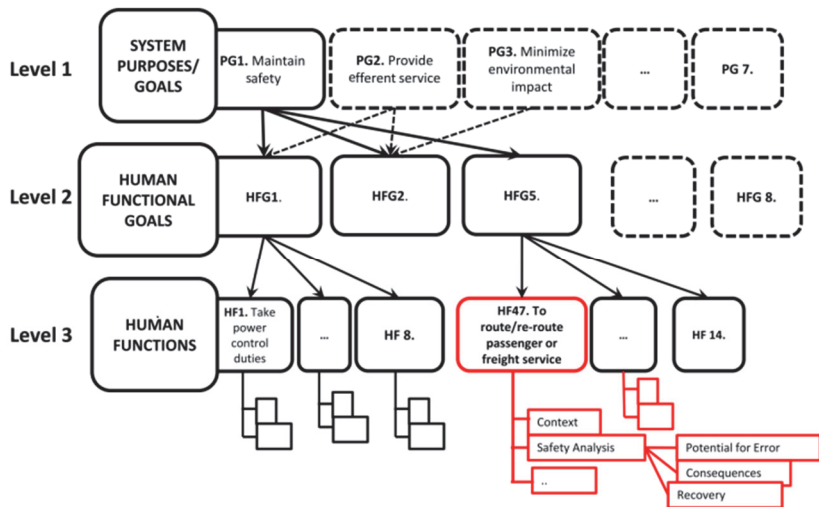


Figure 5.19. Speed profile comparison

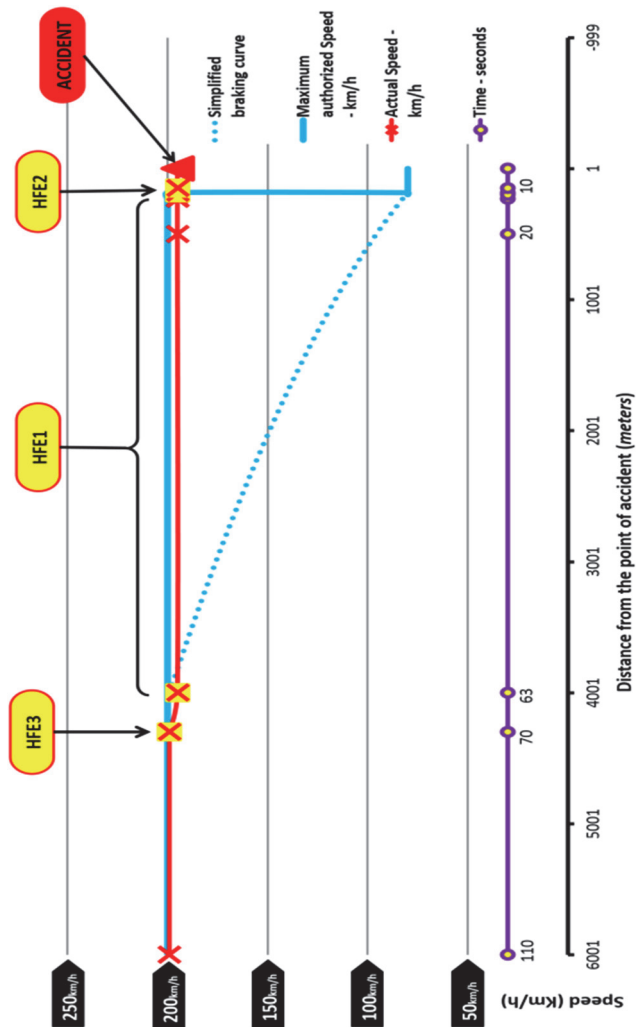


**Figure 5.20.** *Acceleration profile comparison*

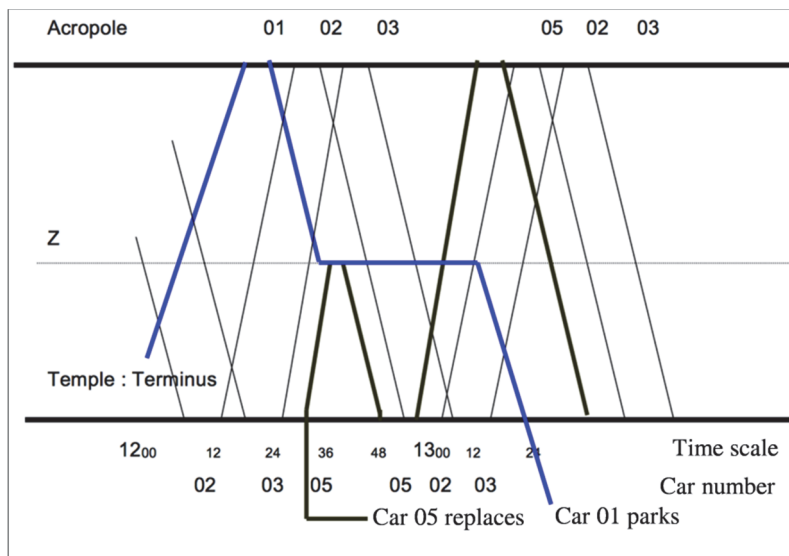




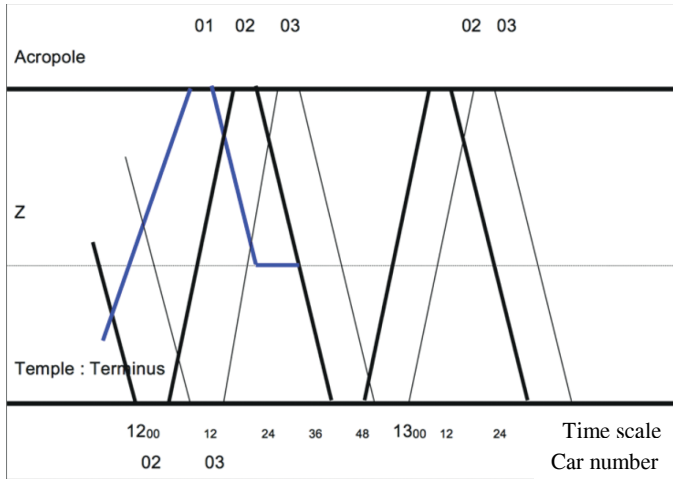
**Figure 6.3.** Using the EUAR HF study for identifying a safety critical context, a refinement of the context related to a human function and then an HFE, based on the data colored in red



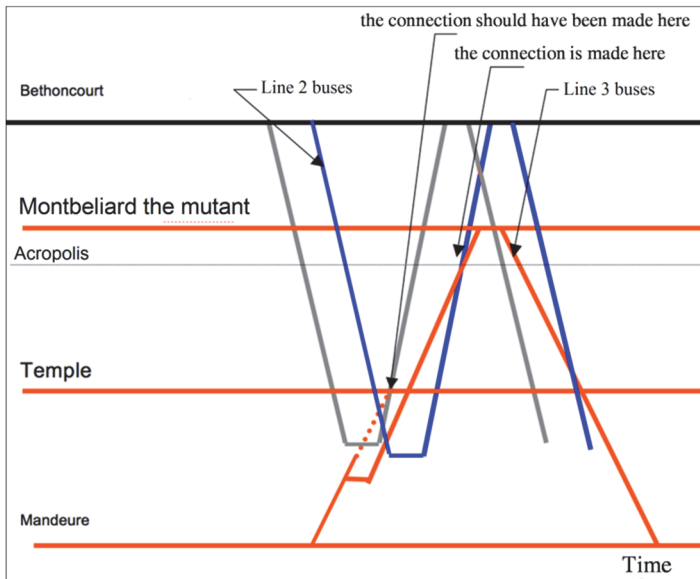
**Figure 6.6.** Accident scenario: train speed as compared to distance from the accident point. Data points (cross marks) are other events identified in the investigation report and HFEs. A time frame is also given



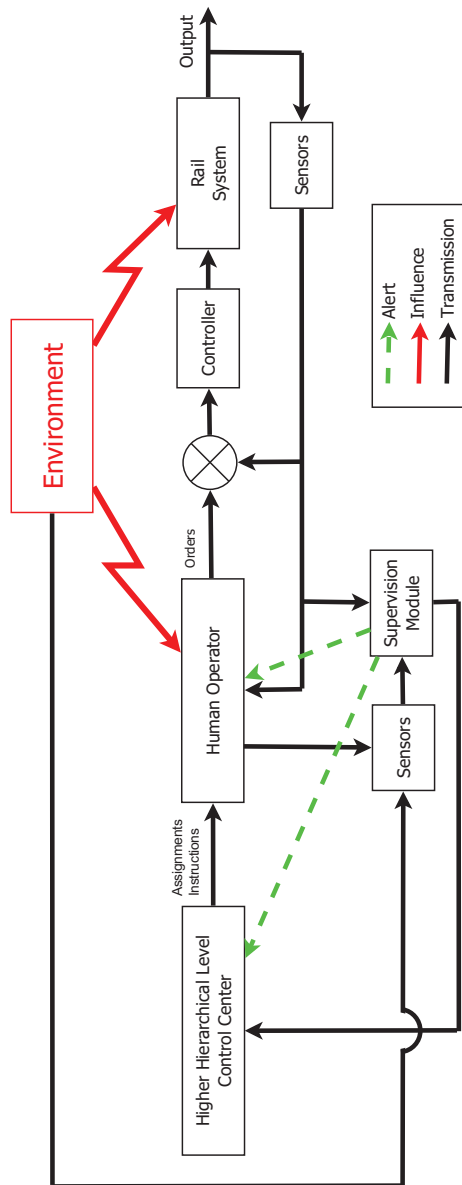
**Figure 7.15.** *Graph of the substitution decision*



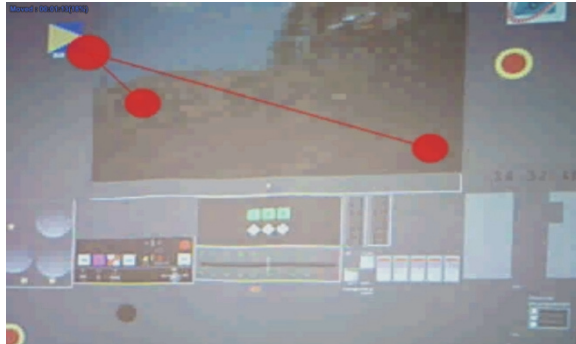
**Figure 7.16.** *Graph of the transshipment decision*



**Figure 7.17.** *Graph of the connection decision*



**Figure 8.4.** *The HMS structure*



*(a) Eye-tracker output*



*(b) Facial recognition output*

**Figure 8.9.** *Example of sensor's outputs*

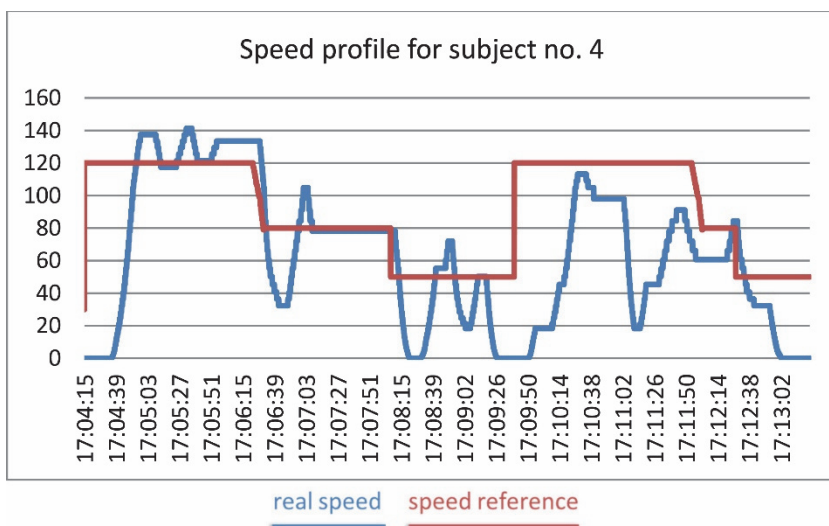
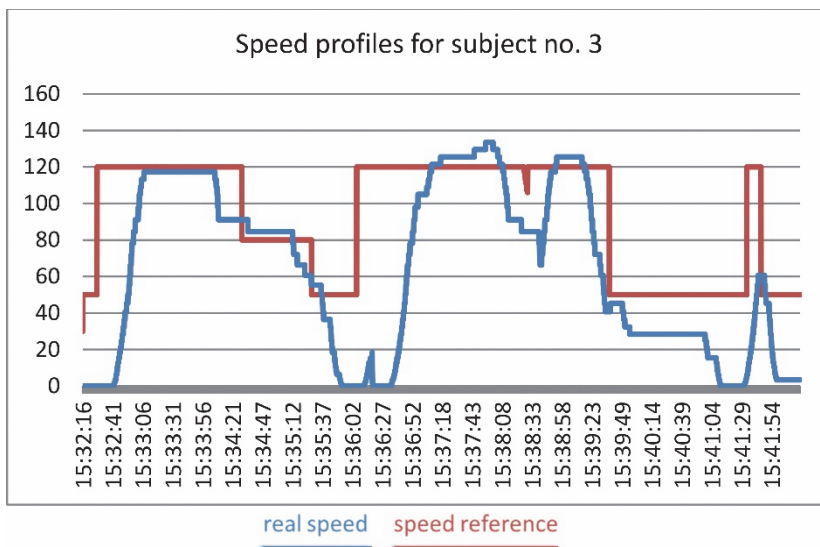
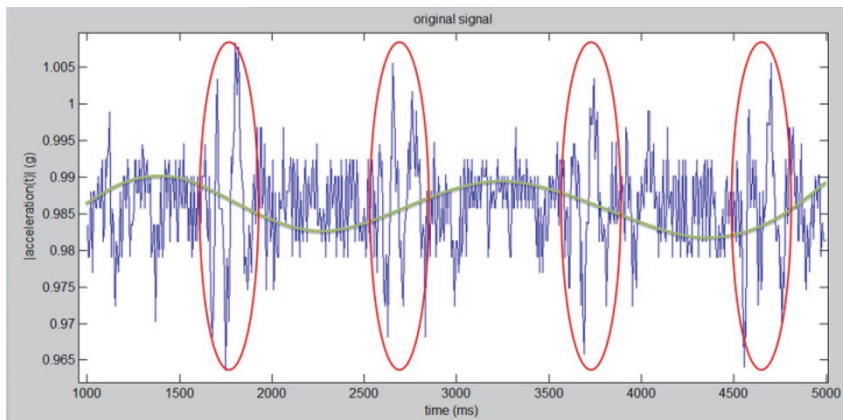
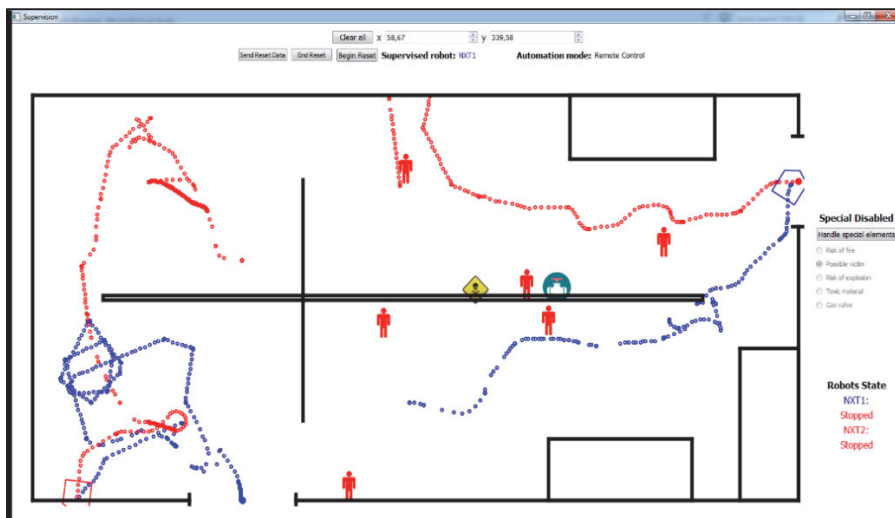


Figure 8.10. Evolution of the train speed compared to the instructions given



**Figure 9.5.** Original signal and its extracted characteristics (heartbeat in red and respiratory cycle in green)



**Figure 9.12.** Human supervisor interface: supervision of the hostile environment





**Figure 10.2.** *Simulation case study using MissRail®*



Figure 10.4. Consumption results of the eco-driving system based on mirror learning