

Cut to length harvester operator skill: How human planning and motor control co-evolve to allow expert performance

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Abstract. Europe's land surface is 33% covered with forests feeding an economy worth 18 billion €. In 2010 475 million m³ timber were processed in Europe (Forest Europe, 2015). Essential for efficient timber production are skilled forestry machine operators to reduce surplus of undesired logging and downtime of the machine. Productivity varies about 40% between trained Cut-to-length (CTL) harvester operators in similar stands (Ovaskainen et al., 2004). The costly efficiency differences are assumed to be associated with aspects of expertise such as deliberate practice of motor skills, situation assessment, and visual perception. Motor learning appears key for mastering smooth crane movements and harvester head control resulting in approx. 4000 control inputs/h. Moreover, situational factors i.e. terrain gradient and assortment potentially covary with skill level and therefore enhancing/limiting the productivity (Berger, 2003). Thus, learning curves vary substantially between operators where learning takes on average 9 months until control skill plateaus (Purfürst, 2010). A lack of proficient education and active supervision in later career stages by experienced mentors may be responsible for large operator performance differences. Previous studies show multiple demands to the operator such as harvesting head and boom control, felling, bucking, delimiting, manoeuvring as well as following the cutting instructions (Apăfăian et al., 2017; Lindroos, et al., 2015; Nuutinen, 2013). Herewith not only motor control but higher-level cognition such as decision making and planning is crucial to achieve a high skill level. The joint European project AVATAR aims to raise operator skill and ease training application in addition to current voluntary programs by designing a digital coach for harvester operators. The initial phase of the project is concerned with the description of the harvester operators' task, the identification of problems in method application (planning and decision making), and the detailed investigation of the co-development of motor action and decision making. At the PhD workshop the current state of the project will be outlined and first results will be discussed.

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