

Selecting successful harvester operators through aptitude tests and demographics

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Background

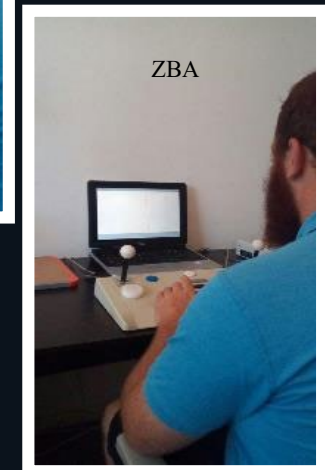
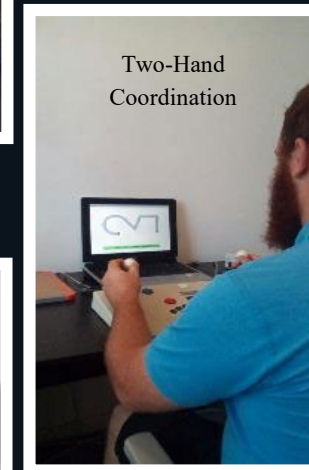
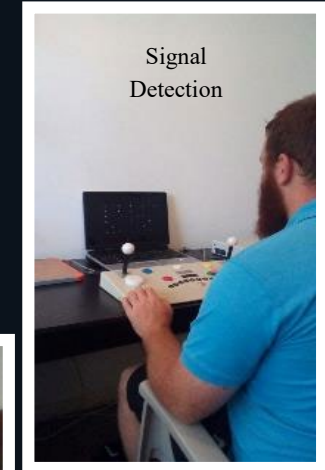
- Increased focus on mechanization of forest activities (specifically harvesting)
- Numerous studies have been conducted on fully mechanized harvesting systems
 - Environment (R.I.L)
 - Silvicultural activities (Coppice)
- Significant concern relating to skills of operators (Purfürst and Erler 2011)
- Specific human abilities

Background (continued)

- Pre-selection of machine operators
- Little information is available relating to the Vienna Test System
- The study aimed at testing
 - i. Vienna Test System
 - ii. Demographics 
 - iii. Specific Components within the Vienna Test System

Materials and Methods

- *Candidate selection*
- *The Vienna Test System (5 subtests)*
 - *Different Classes (A, B+, B, C)*
 - *Specific components (within each subtest)*
- *Demographic Questionnaire*
- *Harvesting Simulator Course and Training*
- *Data collection and Analysis*
 - *John Deere laptop simulator*
 - *Performance indicators*
 - *Kruskal-Wallis test and Mann-Whitney U test*



Results

- *Vienna Test System*
 - (A, n=6) (B+,n=5) and (B,n=3)
- Simulator
 - Initial (nsd at 5 %, $p = 0.1144$) vs Final (highly significant, $p = 0,0098$) work productivity

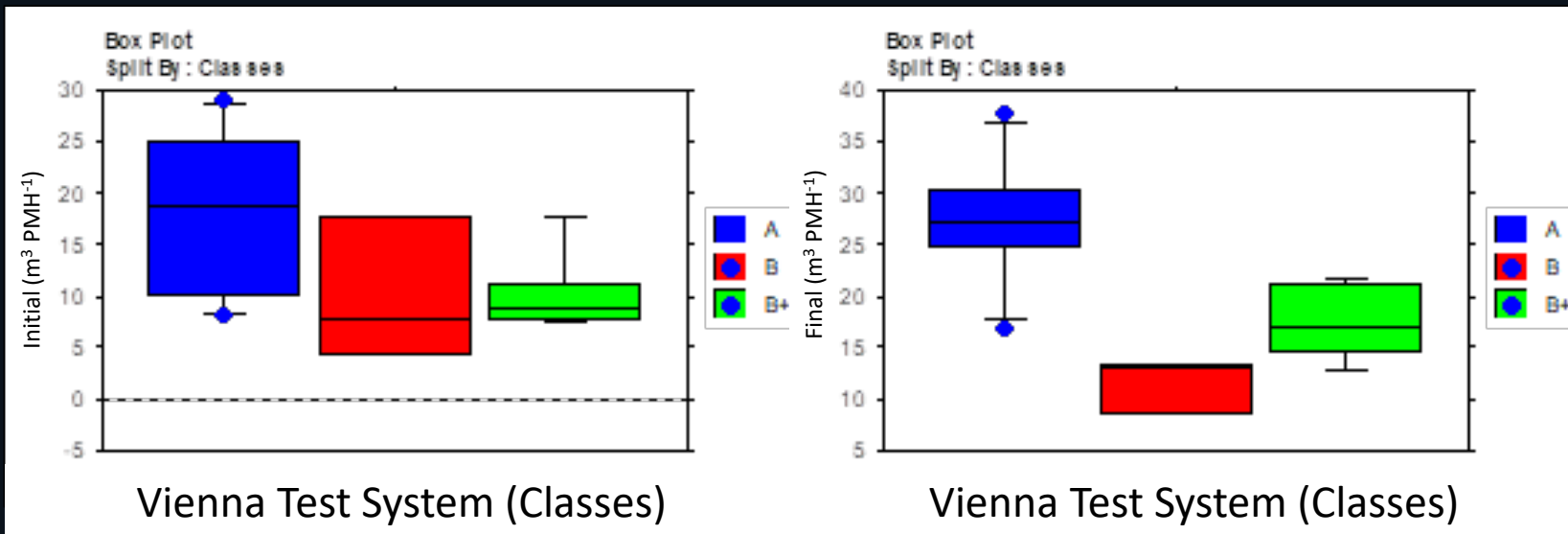


Figure 1: Box and whisker plots illustrating simulator work productivity for the different classes (A, B+, B)

Results

- *Demographics*

- Education
 - Third year, B-Tech and Masters level
- Gender
 - Females 14.7 m³ vs Males 23.5 m³ (60%)
- Gamers vs Non-Gamers (40%)

Table 1: Statistical significance of the performance differences between different groups for Education, Gender and Gaming habits: P-Values resulting from the Kruskal-Wallis test

Performance Indicators	Education	Gender	Gaming
m ³ /PMH initial	0.6930	0.0532	0.2012
m ³ /PMH final	0.8899	0.0388*	0.0503*
m ³ /PMH Increment	0.4890	0.2173	0.5815
% move initial	0.1709	0.8415	0.7809
% move final	0.2256	0.5485	0.1782
%process initial	0.2759	0.0136*	0.1088
% process final	0.7592	0.6407	0.2025
Stump 30 initial	0.5773	0.2023	0.4221
Stump 30 final	0.1479	0.3426	0.2813
Increment Stump 30	0.1962	0.7375	0.8822
Machine damage initial	0.4305	0.8413	0.5448
Machine damage final	0.1328	0.5582	0.4779
Increment Mach. dam.	0.1908	0.6407	0.6926

Results

- *Specific components of the Vienna Test System*
 - Relatively strong relationships ($R^2 \geq 0.2$)
 - reaction time
 - cognitive time
 - correct hits
 - signal correct
 - Work quality
 - hand time and hand error

Table 2: Regression coefficients for the relationship between the various performance indicators (dependent variable) and the scores obtained for specific components of the Vienna test

	Specific Components	m ³ /PMH Initial	m ³ /PMH Final	Stump 30 Final	Machine damage Final
Determ	React time	-0.079	-0.233	0.012	0.024
	Correct hits	0.134	0.456	-0.153	-0.128
Signal	Signal correct	0.014	0.307	-0.004	-0.015
	Signal time	0.148	-0.065	-0.004	-0.001
2 Hand	Hand time	-0.115	-0.035	0.502	0.389
	Hand error	-0.035	-0.133	-0.404	-0.048
Cogni	Cogn Hits	0.003	0.006	0.004	-0.001
	Cogn time accept	-0.184	-0.251	-0.001	0.165
	Cogn time reject	-0.134	-0.162	-0.001	0.134
ZBA	Direction time	-0.029	-0.094	0.347	0.166
	Direction error	-0.04	-0.057	-0.003	-0.093

Conclusion

- The Vienna Test System has the ability to identify fast and productive operators
- Demographics (Males vs Females, Gamers vs Non-gamers)
- Specific components that were identified (ability to quickly make a decision in a complex environment)
- Future research should focus on pre-selection process based on a process of elimination which should include:
 - Personality test
 - Vienna Test System
 - Simulator-based Training

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References

Purfürst F T, Erler J. 2011. The human influence on productivity in harvester operations. *International Journal of Forest Engineering*. 22(2):15–22

Thank You

