Machine simulator study on the effects of a semi-automatic forwarder crane on operator workload and performance.

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Machine simulator study on the effects of a semi-automatic forwarder crane on operator workload and performance.

- Introduction to the simulator and semi-automation
- Methods
- Results
Real-time machine simulator

Troëdsson Forest Technology Lab

3 back projection screens
Semi-automatic forwarder crane

- **Automation**: Moves crane from load area to side of machine.
- **Operator**: Adjusts crane and grabs log.
- **Automation**: Moves crane to load area.
- **Operator**: Adjusts crane and places log.
Semi-automatic forwarder crane for loading
Joystick use

Manual control

Semi-automatic control
Methodology
Methodology

• 11 operators
• Half day of training
• Data collected on 240 crane cycles for each operator on each condition.

• Performance

• Muscle activity (EMG) on forearms and trapezius.
• Mental load (NIRS)
• Subjective rating
NIRS

Trapezius EMG

Forearm EMG
Results

EMG 50th percentile

- **Left arm**
- **Right arm**
- **Left trapezius**
- **Right trapezius**

**EMG (relative to manual condition)**

- **Manual**
- **Auto**
Results

Mental load (NIRS)

- $\Delta \text{HbO}_2$, conventional work
- $\Delta \text{HbO}_2$, semi-automatic work

Average concentration ($\mu$Vol)

Work cycle (sequential number)
Final thoughts
Thank you!