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Difference between experts' and novices' footstep patterns during a palletizing task

Jasmin Vallée-Marcotte
Université Laval

Philippe Corbeil
Université Laval, philippe.corbeil@kin.ulaval.ca

Denys Denis
IRSST, denis.denys@irsst.qc.ca

Xavier Robert-Lachaine
IRSST, xavier.robert-lachaine@irsst.qc.ca

André Plamondon
IRSST, plamondon.andre@irsst.qc.ca

45. Difference between experts' and novices' footstep patterns during a palletizing task

Jasmin Vallée Marcotte[1]; Philippe Corbeil[1]; Denys Denis[2]; Xavier Robert-Lachaine[1,2]; André Plamondon[2]

[1]Department of kinesiology, Laval University, Québec, Canada; [2]Institut de Recherche Robert-Sauvé en Santé et en Sécurité du Travail, Montreal, Canada

Background: Expert handlers handle boxes differently than novices. Their foot motions during transfer allow them to efficiently use box momentum, improving their balance (Authier et al. 1996). However, differences in footstep patterns among novices and experts are often neglected in ergonomic studies as they are rarely the main focus. This study adapts the classification taxonomy developed by Wagner et al. (2009) to compare novice and expert handlers' foot motions during a palletizing task.

Methods: Fifteen experts and 15 novices transferred 24 15-kg boxes (4 boxes high, 3 wide, 2 deep) from one pallet to another 1.5 m away, without foot placement restrictions. Footstep patterns were observed at five points: first contact with the box, pickup, first step following pickup (transfer), last step prior to deposit, and deposit. A taxonomy similar to another study (Wagner et al., 2009) was used to assess foot positions and movements in each phase. Mann-Whitney U-tests were performed to evaluate differences between the frequency of occurrence of footstep patterns in novices and experts ($\alpha<0.05$).

Results: During the lifting phase, experts maintained a static posture of the feet 58.6% and novices 41.3% of the time ($p<0.001$). A "split stance" during lifting was observed more frequently in novices ($\Delta=+11.3\%$, $p=0.02$). Pivot motion of the rear foot during lifting was observed more frequently in novices than experts ($\Delta=+9.4\%$, $p=0.006$).

Conclusion: Differences in experts' and novices' footstep patterns occur only during the lifting phase. Generally, experts stand still while lifting the box, and then move toward the pallet. During lifting, novices' rear foot motions may represent a time-efficiency strategy, whereas experts' static foot positioning may ensure symmetry of movements to minimize joint loading at L5/S1.