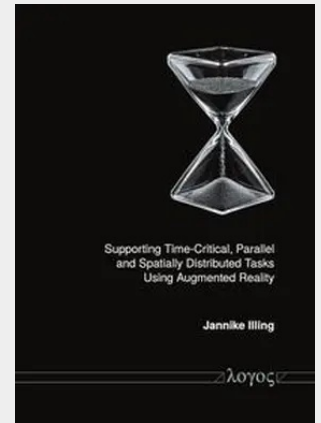


Supporting Time-Critical, Parallel, and Spatially Distributed Tasks Using Augmented Reality

Even in highly automated production environments, some tasks -- such as bonding and assembly -- still rely on human adaptability. These tasks are often time-critical, run in parallel, and are spatially distributed across multiple workstations. How can Augmented Reality (AR) help reduce complexity and support workers in managing these demanding processes? In this dissertation manual manufacturing using bonding as a representative case is investigated and it is explored how AR can assist in the execution of complex, parallel, and time-critical tasks. Following a Human-Centered Design (HCD) approach, the research is grounded in observations and expert interviews, leading to three central research questions: How can time-critical, parallel tasks be visualized within the field of view (FoV)? How can they be guided outside the FoV? How can users gain an overview of distributed tasks? Findings show that AR reduces task complexity, improves performance, and is preferred over traditional instructions. However, supporting more than two concurrent tasks increases cognitive load. For spatially distributed tasks, location-based AR cues alone are not sufficient -- additional peripheral visual signals and spatially registered overviews are essential for effective support.



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