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**Abstract of project**

**"Effects of ageing workers on the performance of manufacturing systems"**

**within the Priority Programme  
funded by German Research Foundation (DFG)**

**"Age-differentiated work systems"**

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## ***Summary***

Production enterprises often attempt to push for the early retirement of aging workers in order to reduce personnel or to replace older workers with younger ones. As a result of the demographic developments in Germany, this will no longer be possible. Therefore, in the near future it will be of great importance to recognise the effects of an aging workforce on the performance capacity of manufacturing systems and to react with appropriate measures.

The goal of the proposed project is to develop a computer-supported procedure for a targeted and efficient alignment of age differentiated manufacturing systems. Personnel-oriented simulation should be exploited in order to determine the effects of the changing performance capacity on the production logistical, personnel-related and quality-related objectives. This approach allows the changes to the performance capacity to be modelled and evaluated according to various aspects using simulation as early as the planning phase. Personnel bottlenecks arising from a changed performance capacity can also be detected in this manner. Within the scope of the configuration of age differentiated manufacturing systems, our goal is to determine the effects of changes in the performance capacity of an aging workforce on the productivity of manufacturing systems in a timely manner and to then use these insights to derive compensation measures for the configuration of age differentiated manufacturing systems and to provide appropriate working conditions for various age groups. The existing workforce should thereby be preserved, and measures for change kept to a minimum, while also taking the existing qualifications and changing scheduling development potential of the workforce into account.



**"Effects of an Aging Workforce on the Performance of Manufacturing Systems" - Project Goals**

SPP - 1997207



Development of a computer-supported procedure for a targeted, efficient alignment of age differentiated manufacturing systems using personnel-oriented simulation

**SIMULATION**

Determination and detection of the effects of a changing performance supply of an aging workforce on the productivity of manufacturing systems

**COMPENSATION**

Derivation of compensation measures for the configuration of age differentiated manufacturing systems

**PRIORITIES**

Recommendations for appropriate working conditions

**Defining the Factors Influencing the Performance Capacity**

SPP - 1997208

**Changes in the functions of the sensory organs:**

- Elasticity of the lens decreases the capacity for accommodation
- Deterioration of visual acuity, hearing and balance
- Compensation through:
  - Increased illumination
  - Improved surrounding conditions
  - ...

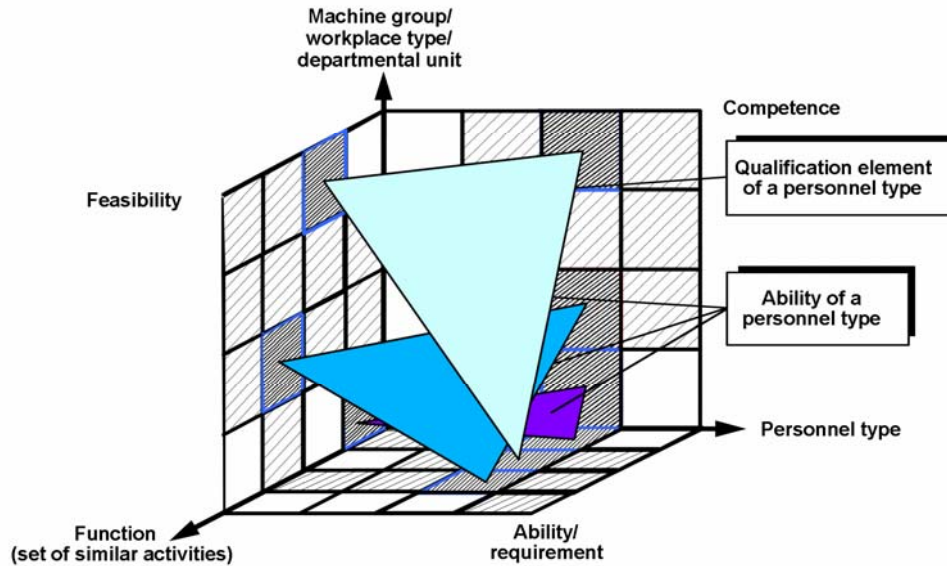
Changes to the functionality of sensory organs are not focus on this research project!

- ? Effects of dexterity (grasping/moving) ↓
- ? Mobility ↓
- ? "Smoothness of transition" ↓
- ? Mental capabilities ←→
- ? Crystallized abilities (e.g. vocabulary, general knowledge) ↑
- ? Experience (years of service) ↑

Work phase goal:  
Modelling factors directly influencing the performance capacity or older workers for a simulation environment

**Modelling of Qualification in Personnel-oriented Simulation Procedures**

acc. Zülch 1995  
PPA - 0023125



**Modelling of Manufacturing Systems**

SPP - 1997209

- Modelling ideal manufacturing systems
- Various forms of manufacturing systems (large, medium and small batch manufacturing)
- Modelling scenarios

**Modelled sub-areas**

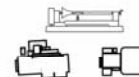
**Product structure:**

- Number of products
- Total quantity of each product
- Type and number of crosslinks between individual work operations
- ...



**Equipment structure:**

- Real machine types
- Wear on machine components
- Variation of equipment
- ...



**Personnel structure:**

- Persons/Personnel types
- Qualifications
- Development ...



## Analysis of the Effects of a Changing Performance Capacity on Manufacturing System Targets

SPP - 1997210

### Variation of the influencing factors

#### Evaluation of manufacturing systems according to multi-criterion objectives:

##### Production logistical

- Lead time of the manufacturing orders,
- Execution of a dispatched order programme
- Personnel utilization

##### Quality-related

- Rework times for sub-quality products
- Rejects

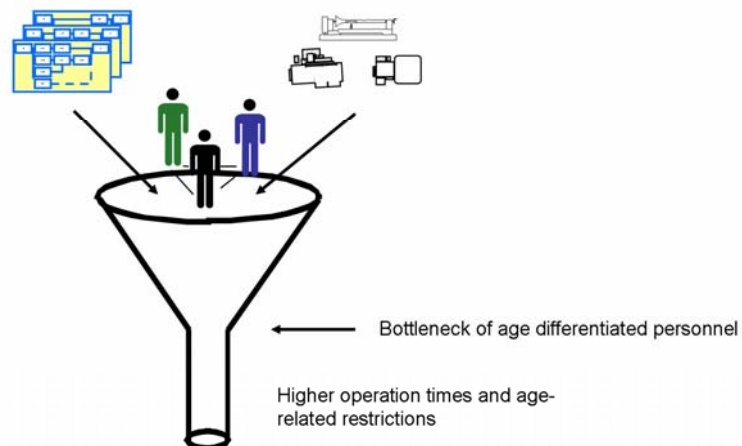
##### Personnel-related

- Consideration of the preferences of manufacturing workers
- Creation of an age differentiated personnel utilization

- Figures are only valid for the simulation modelling space  
- Not for direct transfer to reality  
→ Relevance: trends of differences; Evaluation ranking

## Derivation of Qualification Measure to Compensate for Age-related Bottlenecks

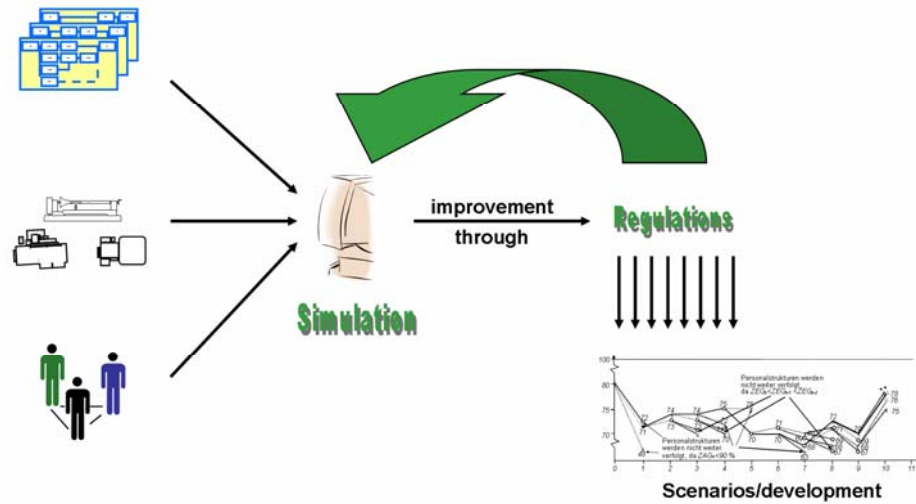
SPP - 1997211



Introduction of training measures  
Rescheduling of workers  
Qualification of younger workers

**Generation of Priority Rules for the Appropriate Division of Work Operations among Age Groups**

SPP - 1997212

**Contact**

SPP - 1997213



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