

## BUILD-IT: Intuitive plant layout mediated by natural interaction

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**Introduction:** We wish to show a method that goes beyond traditional human-computer interaction. Natural interaction, in the context of this paper, means human action in the real world with others humans and/or real objects. A tool bringing together motor and cognitive action is a promising way to assure a complete working cycle. We first make clear the relation between human behavior and complete regulation. Then, we derive guidelines for the next generation of user interfaces, the *Natural User Interface* (NUI). Finally, we present BUILD-IT featuring video-mediated, multi-subject interaction in a task specific context.

**A framework for Natural Interaction:** Aicher [1] shows that the relation between reflection and body is so close that cognitive processing is often rendered visible by the language of the hands. This would mean that mental actions and operations have a strong relation with manual actions and operations (and vice versa). Aicher describes regulation of human activity as a cycle of action, comparison and correction, leading to new action. He claims that often, regulation of human activity is reduced to inner, rational activity.

In the tradition of action regulation theory as described by Ulich [2], motor execution is a vital step to achieve a complete working cycle. To assure complete working conditions for computer mediated activity, we believe that users must be able to behave in a *natural way*. We make this the first point in our NUI guidelines. Another basic requirement is the possibility for exploratory as well as functional action. Furthermore, users must be helped to bring into action all of their body parts (e.g. hands, arms, face and voice). To interpret all of these expressions NUIs bear powerful and intelligent pattern recognition methods.

**The prototype BUILD-IT:** First, we designed a prototype system based on the NUI, called BUILD-IT. It supports engineers in their task of designing assembly lines and building plants.

The design room of Fig. 1 enables users, grouped around a table, to interact in a space of virtual and real world objects. The vertical working area gives a side view of

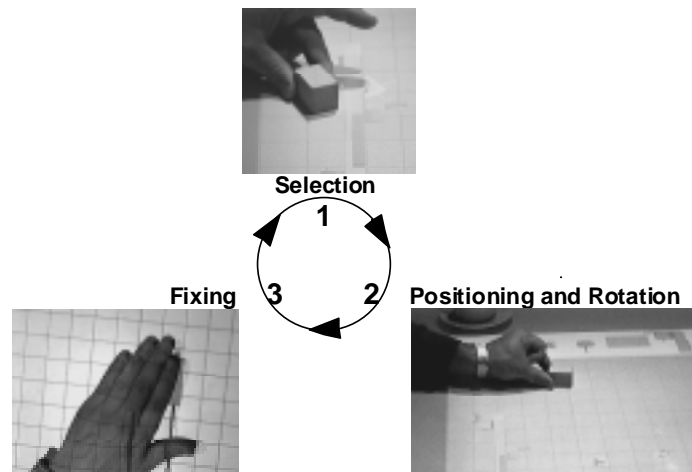
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the plant. In the planar working area there are several above views for object selection and manipulation.



**Fig. 1:** The design room of BUILD-IT

The basic working principles of object manipulation are given by Fig. 2. Object selection, positioning and fixing only require simple brick manipulation. Throughout these steps, there is a strong binding between cognitive processing and observable behavior. The system dynamically supports the user needs for goal setting, planning, action and control. Hence, complete regulation is enhanced at the action and the operation level too. To incorporate several users in a simultaneous design process, the system supports multi-brick interaction.



**Fig. 2:** The basic steps for user manipulations with the interaction handler (brick).

### References

- [1] Aicher O: analog und digital, ernst & sohn, 1991, pp 19-21, 28.
- [2] Ulich E: Arbeitspsychologie, 3rd Ed., vdf, 1994, p 168.