

Spotlight

Usability Engineering: The Future of Human-Machine Interaction in Agricultural Engineering



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Photo: Frank Mühlbauer

It can no longer be ignored: the concept of human-machine interaction is facing considerable changes. The interface as we know it is coming to an end – and this does not mean the switch to the next generation of touch screen displays. We all know that operators of agricultural machinery are far too often over-burdened. Despite coping successfully with this backbreaking work, they receive little acknowledgement, even after 14 hours of hard labour. As a result, the entire sector has difficulty in finding any young people to fill one of the most exciting jobs in agriculture, which is becoming more and more digitalised.

New priorities for the operators of tomorrow

If communication between humans and machinery is to be successful in the future, we must set the right course now and push thoughts of the undoubtedly necessary technology aside for the time being. We will certainly need to tackle the topic of the next key technology, but, first of all, the focus must be on users with their capabilities and needs. We must be much more consistent in keeping the entire process in mind when considering the information that the user sees in the display, instead of only looking at the specific machine. Why is this effort really necessary? Because fully automated farming with self-propelled vehicles will not even be possible all over Germany in the next 10 to 20 years – and by then, the last experts will have retired and those few committed young farmers will have left us by the next software start up due to the existing circumstances.

Thought out from the user perspective and tested by users

Let us start with the user: Although User Centred Design has already achieved the status of an ISO standard for design processes (EN ISO 9241-210), it is nevertheless not yet generally known everywhere. It contains two particularly relevant core statements: The needs and requirements of the user – and not those of the developer – are at the very fore at the start of the design process. Anthropometric, cognitive, emotional and social aspects related to the use of products are considered from this perspective. Concepts developed on the basis of this analysis must be tested and, depending on the results, also substantially adapted (Image 1). This requires – among several other things – interdisciplinary teams and agile prototype tools that are able to iterate quickly and evaluate precisely. Both are by far not yet the standard.

Taking user experience into account right from the start – i.e. directly shaping how the user actually experiences the situation before, during and after use – would be wonderful in this regard but can only be one of the next steps.

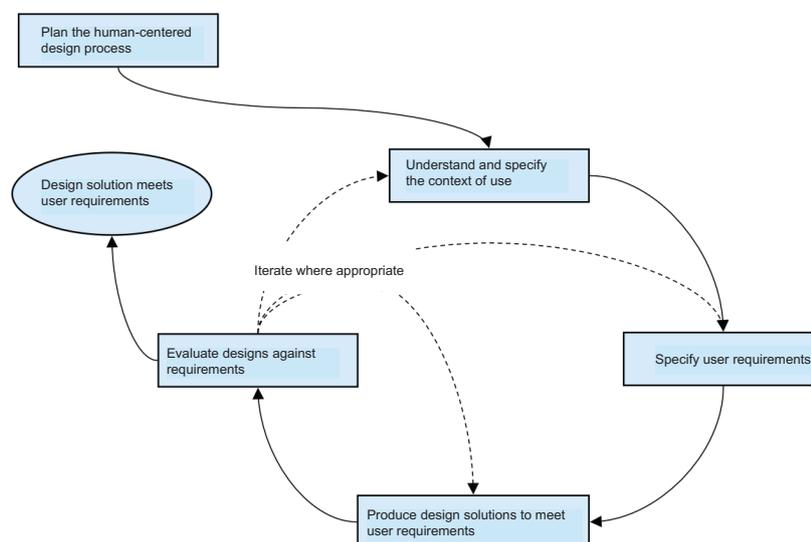


Figure 1: Human-Centered Design Process as per EN ISO 9421-210 standard

The right information instead of traditional data

Now to the information: why do we still believe that the actual driving parameters, e.g. speed, are decisive for the operator? Because that is what we learnt and how we controlled the actual work processes on the basis of such data. There simply was nothing better available. However, adhering to this concept only makes limited sense in view of the increased use of sensors and actuators working directly at the essential spots. Instead, it prevents effective and efficient access to the really relevant process information because this is hidden by all of the so far seemingly necessary displays and thus is not even utilised.

Then what would be conducive? Firstly, a precise description of the system to be examined and its limits, including the processing of really relevant indicators to gain meaningful information. Secondly, a specific analysis of the current situation and the operator's skills as this would make it possible to adaptively derive the actual available room for manoeuvre including real options for action. There should be no holding back on simple solutions: today, every computer game has different expert levels to match the user's skills, and every navigation system provides several easily comprehensible route recommendations to enable quick decisions.

Linked possibilities instead of standardised cabins

With regard to the development of technology, individual solutions with limited validity period cannot be completely detached from two more general considerations. On the one hand, an even more consistent orientation towards consumer electronics than in the past – at least with regard to hardware – is necessary as the scale of development in that area even exceeds the complete off-road segment by far and thus either promotes or prevents technologies, irrespective of the agricultural sector. On the

other hand, it must be clarified which networked infrastructure we will be controlling and steering in the future.

In the Feldschwarm® project, different HMI concepts are examined, among others: an operator controls several attached implements from the cabin of a conventional tractor in the master-slave mode using various new technologies for interaction. In a second concept, the operator navigates from outside the cabin. The swarm consisting of a semi-autonomous tractor with attached implements is now controlled from the edge of the field with the aid of mobile input and output devices. Ultimately, operators and swarm vehicles can be completely separated from each other. The attached implements move autonomously across the field and are monitored from a remote control centre.

As there are also a number of other approaches, we can expect to have different human-machine workplaces side by side in the future, which will have to be designed according to the respective strengths. Only on this basis it can be decided what we can expect from the use of VR glasses or gesture control and what benefits outside on the field will be achieved with it.

Into the field with enthusiasm for IT

The next 5 years will set the course for new, adaptive and motivating forms of interaction with variable mobility. Let us hope that they will help us to actually keep people in the field with enthusiasm for agriculture, mechanical engineering and IT or to bring them back there.

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