Usability makes life easier: DoE tool with user-centred design

Statistical Design of Experiments (DoE) is the method of choice for parame-ter optimisation in process or product development. Its use is recommend-ed in the ICH[1] guidelines and by authorities such as the Food and Drug Administration (FDA). However, the use of DoE is far from standard. What is the reason for this? AICOS Technologies has gained surprising insights and has consequently broken new ground.

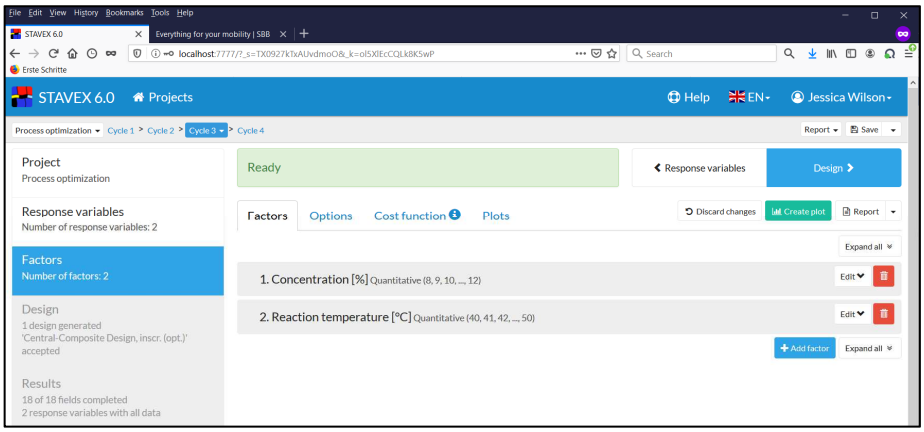

Figure 1: The user interface of the first web-based DoE software. Its use is similar to that of a mobile app, although it is a fully-featured DoE tool that covers everything from initial screening to final optimization.

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When using DoE, one must determine which parameters and which quality attributes (response variables) are to be included. Then a suitable experimental design must be identified, the experiments must be carried out and their results must be analysed. “User-friendly” software tools for this purpose have been available for years. However, everyone has already experienced how tedious it can be to use software or an app. Why is it easy to work with one tool and not the other?

The new magic word is “usability”: by definition (standard DIN EN ISO 9241) it represents the product of effectiveness, efficiency and satisfaction. It is a matter of simply obtaining substantial results without neglecting the emotional component. So, "usability" stands for a paradigm shift. It is no longer the software with its technical capabilities that plays the main role, but the user. It is therefore not a question of how to present the software functions in the most suitable way, but of what is expected or needed in the next step in order to be able to continue working unhindered; and of making the “user experience” as positive as possible.

University research

This is why AICOS Technologies decided to take a completely new approach to the current upgrade of the DoE software STAVEX: in a study with the University of Basel, the design was completely reworked in order to maximize usability. In the conception and further development of the in-house tools, great attention has always been paid to the ease of use and a clear user guidance. However, modern methods recording the user behaviour allow a much more detailed analysis. It becomes clear where users look for the next button, where they pause confusedly, but also where the process is smooth. A particularly interesting result was that many test persons did not use the existing help functions, but directly used a search engine. Video instructions are particularly in demand.

Focus on the users

The resulting product STAVEX 6.0 constitutes the first web-based DoE software. It runs on a company-internal server and can be accessed with standard browsers (Figure 1). Therefore, the use is similar to that of a mobile app, although it is a fully-featured DoE tool that covers everything from initial screening to final optimization. Based on the results of the study, the workflow has been significantly improved compared to version 5.2. All options that are not directly necessary for the workflow have been moved to separate tabs. Moreover, the possibilities for project management have been extended. And, of course, the functions are now also explained in videos. These can also be accessed on our website and on Youtube and thus serve as an introductory tutorial on Design of Experiments.

The “user experience”

A simple input and a smooth process are not only important for efficiency reasons. Together with an appealing layout and beautiful graphics, the use of a software becomes a pleasant experience, which is then crowned by good results. In STAVEX 6.0 the main work lies in the design of the project: for example, temperature, pH and concentration should be set optimally to minimize impurities. Once the problem definition is clear, reading in the data is a piece of cake. Then a suitable experimental design is proposed and the analysis is presented in simple language, supported by meaningful graphics (Figure 2). Furthermore, the software immediately provides suggestions for further action.
The “software tool” thus becomes an easy and pleasant-to-use tool - and is not only used because the authorities or the boss demand it. Such a positive “user experience” leads to DoE actually being anchored in the company as standard.

Wide range of applications

In addition to process optimization in chemistry, DoE is also suitable for pharmaceutical technology (quality optimization in tablet and cream manufacturing) and biotechnology (titer and purity maximization in upstream or downstream processes). Another field of application is the optimization of formulations, for example for pharmaceuticals, detergents and coatings.

The design of STAVEX 6.0 as a web-based tool with easy-to-use interfaces also allows simple integration into laboratory automation systems (automated

[1] International Council for Harmonisation of Technical Requirements for Pharmaceuticals for Human Use

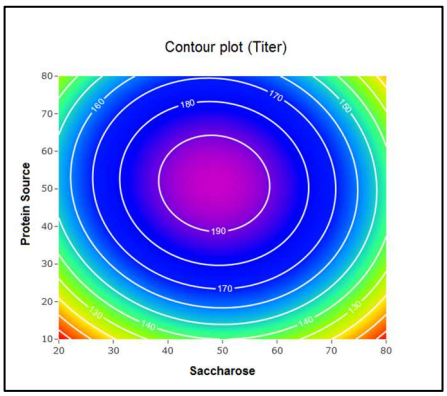

Figure 2: Example of STAVEX graphics: The titer (response variable) is represented in colour, as a function of the amounts of saccharose and protein source (factors). The colour scale ranges from red (minimum) to purple (maximum). It is clearly visible that the maximum titer is above 190.

experiment processing, including analysis) or into laboratory information and management systems (LIMS). The road to self-optimizing processes in the intelligent laboratory of the future is not anymore far away.