

# Replacing user studies with computer simulations

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Currently, product developers evaluate the physical comfort of a newly developed mattress through extensive real-life user studies. Could these studies be replaced by computer simulations? The answer is yes, and this thesis presents dramatic improvements to the accuracy and efficiency of these kinds of simulations.

What are the actual problems replacing user studies with computer simulations solve? Well, for starters - it saves a lot of leg work for the product developers. Arranging an extensive user study requires a large collection of volunteers, with varying physical attributes such as BMI, age, and gender. In the current situation with the corona pandemic (May 2020), this task is almost impossible. But, it is not only during these extraordinary times the advantage of simulated user studies is obvious. They also allow product developers to test a product early on in the process without the need to build a physical prototype, saving valuable development time.

However, the experience of comfort is not only a matter of physical comfort, or lack of physical *discomfort* as defined in this thesis, but has proven to be a partly subjective experience. Which, of course, can not be simulated on the computer. Hence, the purpose of the simulations is not to completely replace the user study, but to increase the efficiency of certain parts of the process. In essence, the computer simulations allow a developer to ask: *Is this mattress uncomfortable?* and the computer either answers: *No, build a prototype for final testing* or: *Yes, because of physical discomfort reason x*. The simulations can, therefore, be used as a tool of design-elimination, rather than final selection. This method eliminates the need for extensive user testing during the development phase of a new mattress, and what remains is a smaller user validation at the end.

As humans, we are not very good at expressing objectively what we perceive as comfortable. However, through some known facts, such as that we want our spine to be straight, we can make qualified guesses on a mattress state of comfort. In this thesis I have made these guesses more accurate, and, through increased efficiency of the simulations, more readily available for further evaluation and improvement. By establishing these methods, the stage is set for the development of a new database, matching body type with mattress preference. Product developers and possibly even customers can then use this database to find the perfect mattress for their individual needs.