SIMULATION FOR EVERYONE: TECHNIQUES TO HELP DEMOCRATIZE SIMULATION

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SUMMARY

Designing, building, and testing, then redesigning, rebuilding, and retesting a physical product is expensive and time-consuming. Simulation can ease these burdens, bringing many advantages, the two most significant of which are saved resources (money and time) and improved, more detailed results. By reusing models created in the design phase, simulation techniques and software eliminates the building and rebuilding phases from the process, which can reduce the time needed to get a product out the door. Simulation can generate results at a level of detail that other validation methods may not match, particularly when results that are either too small to measure or too large to be determined practically, such as surface interactions at an atomic level.

While simulation provides huge advantages, it also has limitations. One is the complexity of tools that are required to run simulations. We want to empower every engineer with simulation tools that are easy to use and adopt, but also ensure that those tools provide accurate results that can be adopted by engineers at all levels.

In order for us to achieve this vision, we need to understand the engineer's design goals as well as the business objectives for those goals and the proper context for using the tools. Once we have an accurate understanding, we can create tools that will provide easy and intuitive means for engineers at all levels to achieve greater productivity and efficiency. A user-centered design (UCD) process can be employed to achieve this goal. UCD is deeply embedded in different sciences, but applied with great care to fit the need appropriately.

In this presentation, we are proposing a UCD methodology as a means to improve engineering simulation software design. The UCD method, when followed, is proven to improve the user experience for legacy users while also making simulation easy for engineers new to the field.

Simulation is a complicated process that traditionally has been used by specialized engineers to predict the behavior of a design in the real world. Our vision is to empower *every* engineer to utilize the full potential of simulation to create better products and to be able to do so in an easy and productive fashion. Walk with us on a journey in which you will see the many easy-to-apply tools of UCD that can be used to build the next generation of simulation software. This is neither a new approach nor a specific prescription, but a path with many different tools to achieve greater productivity and ease-of-use in the simulation world.

1: About UCD

Many systems are designed with a focus on business goals and advanced features, but have limitations posed by available technology. These designs often end up ignoring end-user goals and needs. In order for us to deliver the best user experience for our customers, we need to focus on their needs and understand their mental model. This is enabled by UCD

methodology. A good explanation of user-centered design is available on the Usability First website: “User-Centered Design (UCD) is the process of designing an application’s user interface, from the perspective of how it will be understood and used by a human user. Rather than requiring users to adapt their attitudes and behaviors in order to learn and use a system, a system can be designed to support its intended users’ existing beliefs, attitudes, and behaviors as they relate to the tasks that the system is being designed to support. The result of employing UCD to a system design is a product that offers a more efficient, satisfying, and user-friendly experience for the user, which is likely to increase sales and customer loyalty.” According to ISO “UCD is an approach to systems design and development that aims to make interactive systems more usable by focusing on the use of the system and applying human factors/ergonomics and usability knowledge and techniques.” We believe that designing software with a focus on user needs and following a UCD process will help produce software that is more user friendly and easier to use.

2: UCD Process

There are a number of ways that UCD can be incorporated into the product development process. In this presentation, we will discuss the UCD approach we follow at ANSYS for designing our simulation software. We have divided the design process into four stages, Discover, Design, Validate and Deliver.

Discover is the initial stage, where we conduct research activities such as ethnographic (user) studies, stakeholder interviews, focus groups, usability research studies, and surveys. After obtaining a good understanding of users/potential users and their needs and business objectives, we move on to the next stage.

Design is where we apply tools such as the design studio approach. In this approach we collaborate with appropriate stakeholders to come up with an initial design based on requirements. We use this initial design as basis for creating and testing the prototypes, which leads us to the next stage of our process.

Validate is the stage that allows us to test our design ideas and revise the designs based on usability testing, similar to how engineers test, modify, and retest employing simulation techniques. Like the simulation world, we revise and retest until we achieve our desired goals, ensuring an intuitive and well-balanced design that exceeds user expectations.

Delivery is the stage where we create detailed visual design specifications and deliver visual artifacts. These are very similar to the simulation results that are used to create actual products, our detailed designs and artifacts are used to create actual simulation software. And again, like the simulation world, when you build the actual physical product you want to test and ensure it meets all requirements, so do we test our completed software through usability testing to ensure it meets our user expectations.

Figure 1: Various stages and tools of the UCD process

3: Tracking the UX Improvement

One of the most widely accepted and standard ways to measure product usability is the System Usability Score (SUS) [1]. We use SUS to measure how well our current software is performing and compare it to the new design. In order to measure the SUS, we ask our users to use the software and fill out an SUS questionnaire at the end of their experience. The SUS questionnaire consists of 10 multiple choice questions (as shown in Figure 2) and an average score is calculated based on the responses.

	The System Usability Scale Standard Version		Strongly disagree				Strongly agree
			1	2	3	4	5
1	I think that I would like to use this system.		O	O	O	O	O
2	I found the system unnecessarily complex.		O	O	O	O	O
3	I thought the system was easy to use.		O	O	O	O	O
4	I think that I would need the support of a technical person to be able to use this system.		O	O	O	O	O
5	I found the various functions in the system were well integrated.		O	O	O	O	O
6	I thought there was too much inconsistency in this system.		O	O	O	O	O
7	I would imagine that most people would learn to use this system very quickly.		O	O	O	O	O
8	I found the system very cumbersome to use.		O	O	O	O	O
9	I felt very confident using the system.		O	O	O	O	O
10	I needed to learn a lot of things before I could get going with this system.		O	O	O	O	O

Figure 2: System Usability Scale questionnaire

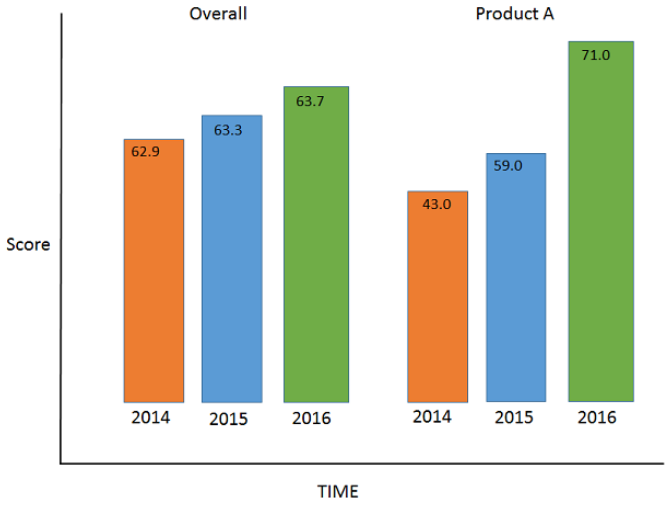

Figure 3: Showing an upward trend in system usability improvement

There are other methods that can be used to measure the usability/user experience of the design, such as usability evaluations (using metrics like time to complete task, error rate, number of clicks, etc.), surveys, interviews. Many free online resources from websites like www.usability.gov are available, and can provide a basic understanding of how to use the tools. Use assessment methods to measure the current state of your software usability, and then use it as a benchmark to improve your designs through time.

4: Conclusion

In conclusion, we have described a UCD process that can be used to improve the usability of simulation software and thereby democratizing it for more novice users. This will help to increase the number of simulation users in various engineering fields, and thereby increase innovation, and improve the quality of products that we all use day-to-day.

REFERENCES

[1] Bangor, A., Kortum, P. T., Miller, J. T. (2008). An Empirical Evaluation of the System Usability Scale. International Journal of Human-Computer Interaction. 24, 574—594