

Decision makers need contextual interactive guidance

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As decision makers balance economic, environmental and social aspects of living, planners and others need decision-making tools that support the process, but do not dictate the outcomes, so that trade-off choices can reflect a wide array of needs, according to a team of researchers who looked at an interactive program using trade-off diagrams.

"We are seeing a massive growth in the use of [decision](#) support systems, particularly ones branching into the use of more immersive technology," said Danielle Oprean, assistant professor of information science and technology, University of Missouri, and former Penn State postdoctoral fellow. "However, we still do not know much about how current systems and human decision makers interact in complex scenarios."

The researchers were looking for a tool that would lead decision makers in the right direction, allow compromises, but not dictate the results. The types of decisions are not clear cut, but require a give-and-take to find the point where all the constituent sides are balanced as best they can be.

"Say you have a village next to a [lake](#) and the lake is used for recreation and fishing," said Klaus Keller, professor of geoscience and director, Penn State Center for Climate Risk Management. "If phosphorus-containing wastewater is going into the lake, the lake will become overgrown with algae and the fish will die. Reducing the phosphorous inputs into the lake costs money. Loss of fishing costs money and recreation."

The challenge is to find the low-cost strategy to reduce the phosphorous and keep the lake safe for recreation and fishing. And this is a problem with only one decision over time: How much to reduce phosphorus inputs into the lake. Other problems, with more variables, become far more complex.

The researchers created a computer interface for a decision support system using trade-off diagrams that can be altered by the user. Not only can the input number of decisions be changed, but the point of view of the resulting diagrams can also be moved.

"One of the most important things is to run this type of system by human users," said Alexander Klippel, professor of geography and inaugural director of the Center for Immersive Experiences. "We need to take users into consideration. Users don't always behave the way we think they will. People don't always follow directions."

The researchers presented the results of their study at the 52nd Hawaii International Conference on System Sciences and the results appear in the conference proceedings. The researchers found that contextual information in the diagrams increased decision quality. Although contextual information is often difficult to incorporate into the models and makes the diagrams specific to the situation, the researchers considered it beneficial.

Interactivity also improved decision-making quality, but to a lesser extent than context. The researchers suggest that if resources are limited, incorporating context should take priority over interactivity.

The researchers also found that as problems became more complex, the usefulness of trade-off diagrams alone became less valuable. They concluded that we need to better understand how decision support systems can actually assist human decision makers by systematically

investigating visualizations beyond trade-off diagrams.

"I would like to see more exploration of decision-making visualizations in increasingly complex decision spaces," said Oprean. "It is important to understand how these visualizations impact human [decision makers](#) and then use that information to improve decision-support systems that may start to use virtual and augmented reality."

Provided by Pennsylvania State University

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