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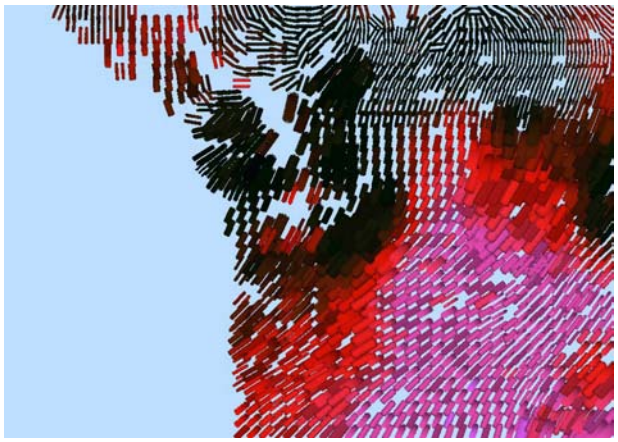
Professor Uses Art to "Paint" Meaning Into Data Displays

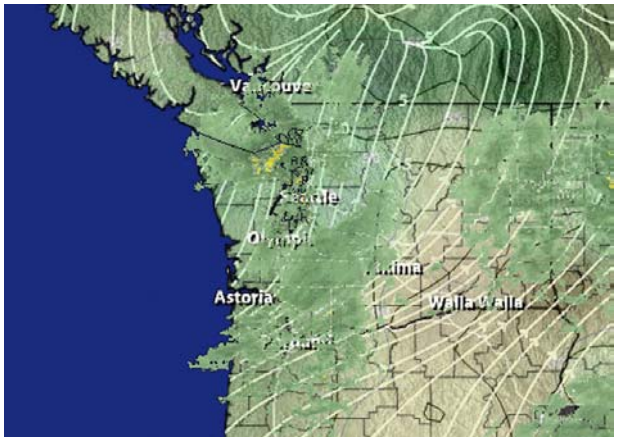
FOR IMMEDIATE RELEASE

Claude Monet would probably never have guessed his revolutionary style of painting would someday be used to make large, complex data sets – such as weather maps – easier to understand.



While a traditional weather map can contain obscured information, Dr. Christopher Healey's weather map uses Impressionist painting techniques to make complex data sets easier to understand.

But Dr. Christopher Healey, associate professor in the North Carolina State University Department of Computer Science, and Laura Tateosian, a Ph.D. student in computer science, combined Impressionist painting techniques with principles of human perception and cognitive psychology to develop a computer visualization system that makes interpretation of large, complex data sets more efficient.



One of the greatest challenges to such a system is the simultaneous display of multiple data values at each location in the image. Traditional weather maps, for example, display each value in a distinct way, such as by using color for temperature, cloud cover for precipitation or lines for cold fronts. At some point, however, the cloud cover will obscure the temperature display, making determining the temperature at certain locations more difficult. On top of this, this method can result in cluttered, sometimes confusing images.

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This traditional method also does not take advantage of what Healey described as the "low-level capabilities" of the human visual system, and its ability to process visual information at a "pre-attentive" level, before the brain has to get too involved in what is being seen.

"We have many methods that are effective for processing a single element of a multi-dimensional data set," Healey said. "Beyond that, things become more difficult."

Based on his research, Healey developed a system that combined the display of multiple values into a single visual element, essentially a "brush stroke" on the displayed image. Weather data displayed using Healey's method shows temperature as color, precipitation as stroke size and prevailing wind as stroke direction.

"A large, red brush stroke means it's hot and raining," Healey said. "There is a consistent spatial correlation that you don't have to think about. It just jumps out at you."

A major focus of Healey's study is identifying methods that will make areas of specific interest to researchers using his system "jump out" more readily. For this reason, Healey's system incorporates artificial intelligence that can be used to tailor the display of multiple data values to a user's preferences or needs, including the ability to turn display of individual values on and off.

"There are some conventions that can't be altered," Healey said. "For example, using color to represent temperature is almost universal in the display of weather data."

Healey said that one goal of his system was to build the context of the interpretation into the visualization, and to lock down the visual properties that contribute to the most effective use of the data. For weather data, for example, Healey said the use of the "painted image" display made interpretation and analysis of the data "much easier."

Healey's work has been used successfully to create visualizations of data sets that include up to seven values, in addition to their two- or three-dimensional location within the display.

"Furthermore, when the displayed data is set in motion, to represent, say, changing values over time, the amount of data available for interpretation increases to include one or two additional values," Healey said.

Clear presentation of the underlying information is the first priority of Healey's research, and the relationship between the effectiveness of this presentation and aesthetics remains one of the questions that Healey's research is trying to answer.

"If the information is displayed effectively, but is not necessarily pleasing to look at, does this even matter?" Healey said. "Or, on the other hand, do aesthetics play a larger role in the effectiveness of the presentation of information?"

One distinct advantage of Healey's system is that the user can remain a "domain expert," concentrating on processing the information in his field of interest, without having to be

computer visualization expert as well. Healey's visualization software has been placed in the public domain, and its use is being investigated by researchers at SAS Institute in Cary.

Healey began his studies in computer visualization and human perception during graduate school at the University of British Columbia in Vancouver, Canada, where Healey said he learned a lot about how the human visual system sees at the pre-attentive level.

"It was essentially a matter of answering three questions," Healey said. "What is easy to discern? What is not? Why?"

Primary funding for Healey's research is provided by the National Science Foundation. Additional funding was provided by Microsoft for an experimental implementation of the visualization system on the PocketPC platform.

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