Inferences from Weather Maps:
Do you need a Weatherman to know which way the Wind Blows?

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Although there is a growing body of literature on how people interpret graphical displays, few studies to date have examined how people apply domain knowledge to make inferences from complex graphical displays. Meteorology is an excellent domain in which to investigate these questions, because the displays in this domain can be quite complex and because they are typically used to make predictions about future weather conditions. Weather forecasting depends both on the ability to understand the current weather conditions from a map, and the ability to apply knowledge of meteorological principles to make predictions about how these weather conditions will change in the future.

Method

In 3 experiments, we asked experts (meteorologists at a Naval Research Laboratory), novices (geography students who had taken one course in meteorology) and naïve students (psychology students with no formal training in meteorology) to make predictions about changes in weather conditions on the basis of US weather maps showing information about pressure and temperature. An example map is shown in Figure 1. This task involves applying two meteorological principles (the Pressure Differential principle and the Coriolis effect) to infer the wind direction and the resulting temperature change at a targeted area. We also measured participants' knowledge of the meteorological principles involved in the weather prediction task.

Results and Discussion

The experts were extremely consistent in their predictions, indicating that there is an agreed-upon correct prediction for each task. Novices and naïve individuals were compared on their ability to make these predictions and their knowledge of the underlying meteorology principles on which the predictions are based. Although almost all novices were able to state the principles correctly, and were much superior to naïve individuals on this measure, the two groups did not differ on their ability to make inferences from the weather maps.

We will report on three experiments that aimed to understand this dissociation between knowledge of meteorology principles and ability to apply these principles to make predictions from weather maps. Possible sources of error that were considered in these experiments included failure to correctly interpret some aspects of the display, display complexity, failure to activate relevant knowledge of meteorology in the context of the weather prediction task, and the application of naïve heuristics about meteorology to the prediction task.

Preliminary results indicate that novice participants understood the displays correctly and that display complexity had a moderate effect on performance. However, even with optimal displays, novice participants had close to chance levels of performance on the weather prediction task. Analyses of verbal protocols and explanations of their responses indicated that novices applied a variety of inappropriate heuristics to the weather prediction task, in addition to the correct meteorological principles. These heuristics were based on both correct rules (e.g., "weather patterns move from West to East") and incorrect rules ("high pressure brings warm temperatures, low pressure brings cold temperatures"). Hints intended to activate their knowledge of the relevant meteorological principles did not affect performance. These results suggest that ability to interpret graphic displays and possession of the relevant knowledge are not sufficient conditions for making correct inferences from graphic displays.

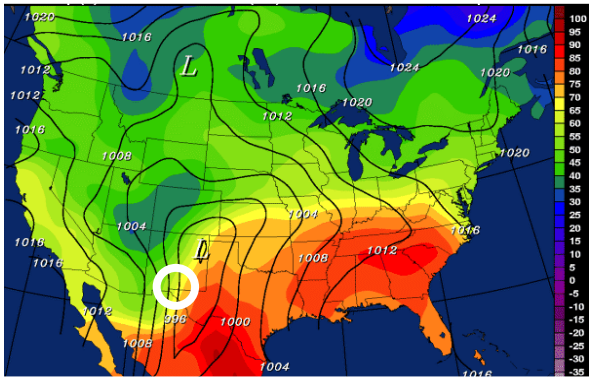

Figure 1. Sample weather map shown to participants. Their task was to judge whether the area marked with the circle would get warmer or colder.

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