Master 2 Intership Proposal:
Communicating Water Scarcity and Uncertainty for Decision Making

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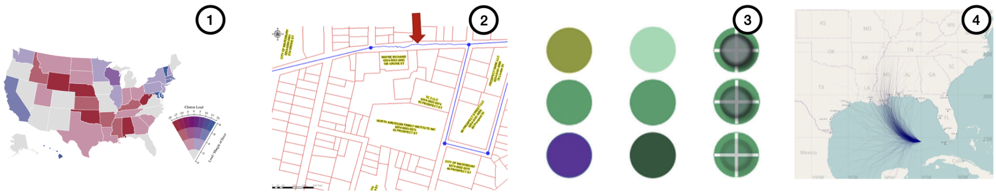

Figure 1. Different visual encodings to depict uncertainty (1) Value suppressing color palette [2], (2) sketchiness [1], blending and fuziness [3] and an ensemble plot [5]

Context

France is affected by a drought that has disrupted its agriculture, livestock breeding and production of renewable electricity besides leaving several cities without direct drinking water. The problem has become so critical that in April this year the French government put in place a set of guidelines[1] for public services to prevent the risks of lack of water in its whole territory. Existing visualizations such as InfoSecheresse[2] or the ones at BRGM [3] provide insightful information about the current levels of water. However, these visualizations do not include possible predictions that give citizens an idea about what to expect in the future. Furthermore, these visualization do not include the levels of uncertainty linked to the models that give these predictions.

Creating and evaluating effective representations of uncertain climate data for general public becomes a key factor to make people understand the current situation and its stakes. Even if multiple visualizations approaches have been studied, such as sketch based visualizations [1], color palettes [2] and others [3], designing effective visualizations of uncertainty is still a challenge. This is even more challenging when we want to include the information of one or multiple forecasts over time, like the explored techniques to depict hurricanes in the study by Liu *et al.* [5] or time series like the COVID-19 forecasts in the study by Padilla *et al.* [7] shown in Figure 2. Furthermore, uncertainty data visualizations need to consider the affective factors that they might produce, such as empathy [4] or the promotion of altruistic and prosocial behaviours [6].

[1] https://www.gouvernement.fr/preservons-notre-ressource-en-eau/secheresse
[2] https://info-secheresse.fr/ [3] https://www.brgm.fr/fr/actualite/communique-presse/nappes-eau-souterraine-

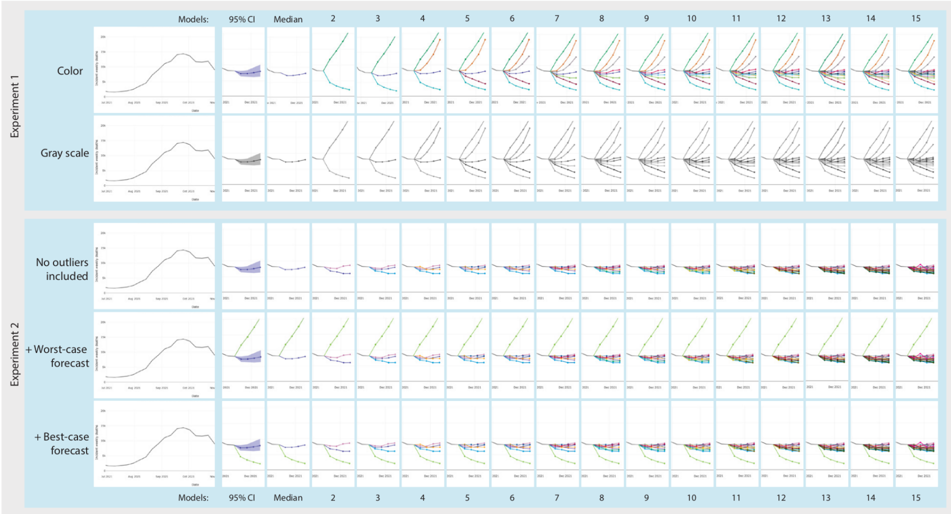

Figure 2. Stimuli used in the evaluation of Padilla *et al.* [7]. It shows several COVID-19 mortality forecasts for November 13, 2021 in the US.

Internship Goal

The main goal of the internship is to explore and evaluate the impact of visualizations of uncertainty in water availability data. For this, we will consider different visualization types to represent uncertain drought events varying in their temporal (e.g. next week or next year) and spatial proximity (e.g. same city, same neighborhood) to the audience.

To do so, the internship will be divided in the following four tasks:

- Make a review of the available spatio-temportal uncertainty visualizations to depict water availability and scarcity over time.
- Assess their capabilities and limitations, both based on their use with real data and the review of available perception studies.
- Given the results above, select a set of appropriate visualizations that can be used in our context. If none appears to be sufficient, propose new visualizations that resolve the limitations of the ones currently available.
- Design and conduct a user study to assess the effectiveness of the visualization. In particular, this user study must focus on analyzing how readers understand these visualizations and what affective responses they produce.

Requirements for Applicants: Basics of Information Visualization, user evaluation and prototyping methods. Any past experience in web development is a big plus.

If this internship is successful, it might be possible to continue this work through a PhD.

Duration and period: 5 or 6 months starting in March/April.

Location: Université Paris-Saclay, Bâtiment 660.

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