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Revealing Uncertainties in Noise Models: Visual Detection Using Online Webcam Eye-Tracking and Mobile Eye-Tracker

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Abstract:

The European Union has introduced the Common Noise Assessment Methods in Europe (CNOSSOS-EU) as a method for assessing noise from various sources, such as roadways, railways, industrial sources, and aircraft (Kephalopoulos et al., 2012). The implementation of CNOSSOS-EU in modelling road traffic noise has been used to estimate population exposure in Ireland (Faulkner and Murphy, 2022).

Spatial modelling can contain uncertainties from various sources. This preliminary study generated noise models for Munich and Jakarta. However, they are still not representative since noise emissions were only considered from road traffic. Additionally, noise levels vary throughout the day, evening, and night. Nonetheless, the noise model is a static visualisation that can only show the average noise level over 24 hours. Based on these examples of uncertainties, the main aim of this study is to reveal these uncertainties arising from the noise models visually.

One study has demonstrated that eye-tracking can significantly aid in evaluating map design and exploring the cognitive processes of map users (Keskin and Kettunen, 2023). Moreover, eye tracking is extensively used to measure cognitive processes and visual attention for various spatiotemporal tasks involving maps and geo visualisations (Peter Kiefer and Duchowski, 2017). Hence, this study will also compare the use of a mobile eye-tracker from PupilLab and an online webcam eye-tracker by RealEye for evaluating noise models.

The between-subjects design user experiments will involve a minimum of thirty people from diverse educational backgrounds. The participants will be divided into two groups. The first group will use a mobile eye tracker, and the other will use an online webcam eye tracker. We will utilise multiple-choice questions to investigate how participants identify noisy areas and recognise uncertainties within the noise model. Additionally, we aim to understand how they make decisions based solely on the model. The analysis will employ metrics such as fixation, gaze, and mouse clicks to evaluate the effectiveness of both eye-tracking methods.

The mobile eye-tracking records the fixation and gaze, and then we can do more processing on the cloud (see figure 1). Meanwhile, the online webcam eye-tracking also shows mouse click, the attention and the emotions of the user, as shown in the figure 2 below:

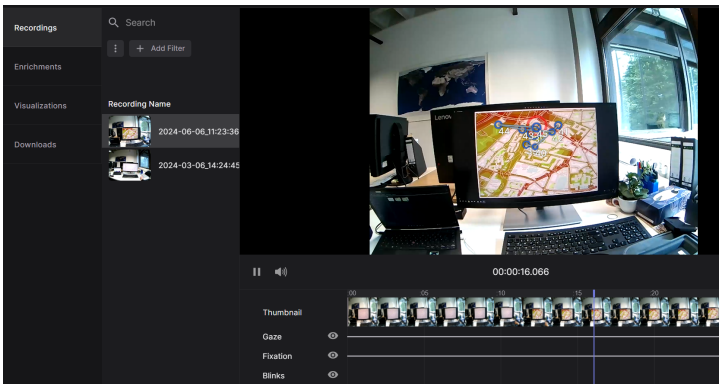

Figure 1. Mobile eye-tracker result on the cloud

Figure 2. Online webcam eye-tracker result

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