BEYOND WRONG TURNS

The Impact of Lane-Level Guidance and Distraction on the Cognitive Mechanisms of Navigation Errors

MSc. Design For Interaction
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Research Question

RQ1: How can **navigation errors** (missed turns, wrong turns, risky turns) be classified and mapped to underlying **cognitive processing failures** such as perception, interpretation, or decision-making failures?

RQ2: How do **cognitive distraction** and the **level of map guidance detail** (road-level or lane-level) at urban intersections influence the occurrence of these cognitive processing failures and associated navigation errors?

Study Design

40 participants completed a 2×2 within-subjects driving simulator study, navigating through 4 urban routes

Independent variables

Cognitive distraction (present vs. absent) x Map guidance detail (road vs. lane-level)

Dependent measures

Navigation errors, eye-tracking (200Hz), driving behavior, NASA-TLX, UEQ

Key Research Finding

LLN significantly reduced **interpretation failures** (misunderstanding map instructions) and **wrong turn errors**, contributing to better situational awareness and **navigational performance** in urban scenarios.

LLN changed drivers' gaze behaviors on navigation screen: (1) more **attention reallocated** from road to navigation; (2) more frequent and longer fixations to **process information**; (3) more dispersed gaze suggesting **wider visual scan**

LLN significantly benefits **more experienced** drivers in reducing navigation errors and cognitive load, with greater flexibility in adapting to different map guidance details. In contrast, LLN shows limited benefits for **less experienced** drivers and may increase their chance of missing turns.