Foot-LITE
enabling safe & green driving

Smart Driving Aids and their Effects on Driving Performance and Driver Distraction

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Presentation Overview

- What is Foot-LITE?
- Introduction
  - General Background
  - Human Machine Interface (HMI) Design
- Methodology
- Results
- Conclusions

What is Foot-LITE?

- Foot-LITE is a UK project which aims to encourage ‘Smart’ driving behaviours
  - Encompasses both Green and Safe driving
- 12 consortium members in project
- Jointly funded by TSB, DfT and EPSRC

How will this be achieved?

- Two aspects – On and Offline component
- In-vehicle human machine interface (HMI)
  - Deliver pertinent and timely information and advice on driving parameters and performance
- PC based back office server
  - Store and compare journey data, pre journey planning, longer term tips and advice

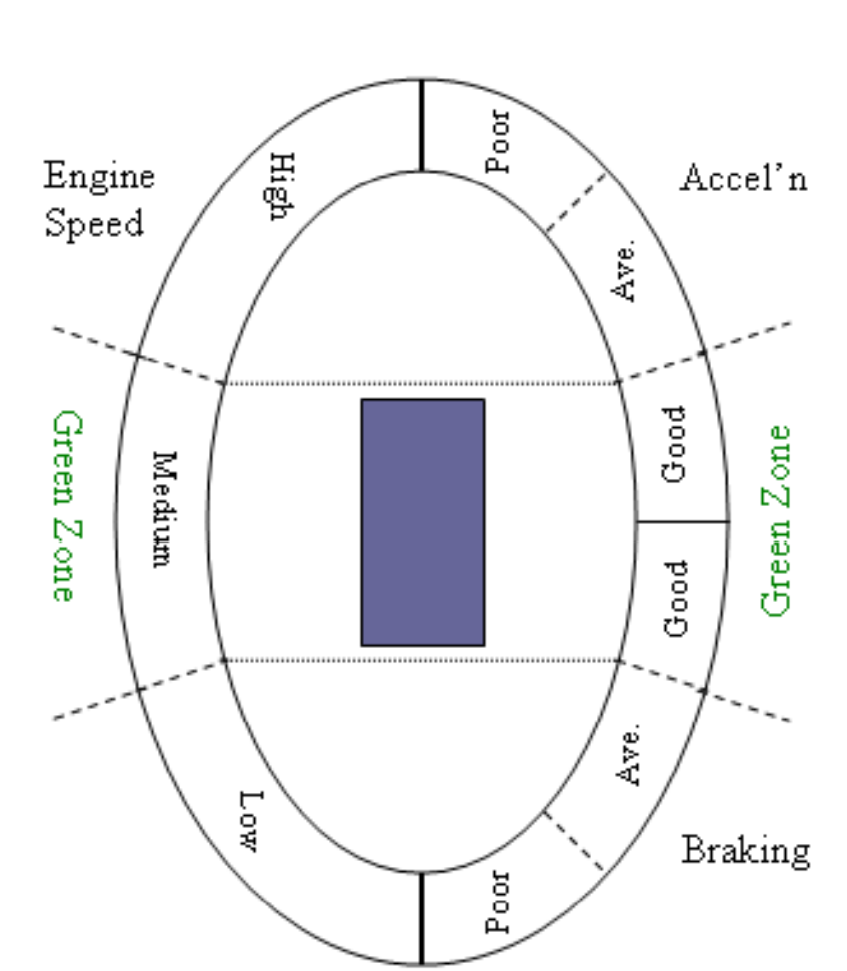
Introduction

- In-vehicle information systems (IVIS) can increase workload and cause distraction
- Both are causal factors for accidents
- The full extent of IVIS distraction related accidents is difficult to determine
- Dramatic proliferation of such systems

Introduction – HMI

- Two very different HMI designs
- Information presented
  - Gear Change Up and Down
  - Acceleration and Braking events
  - Headway
  - Lane Position and Deviation
- Both displays showed same information

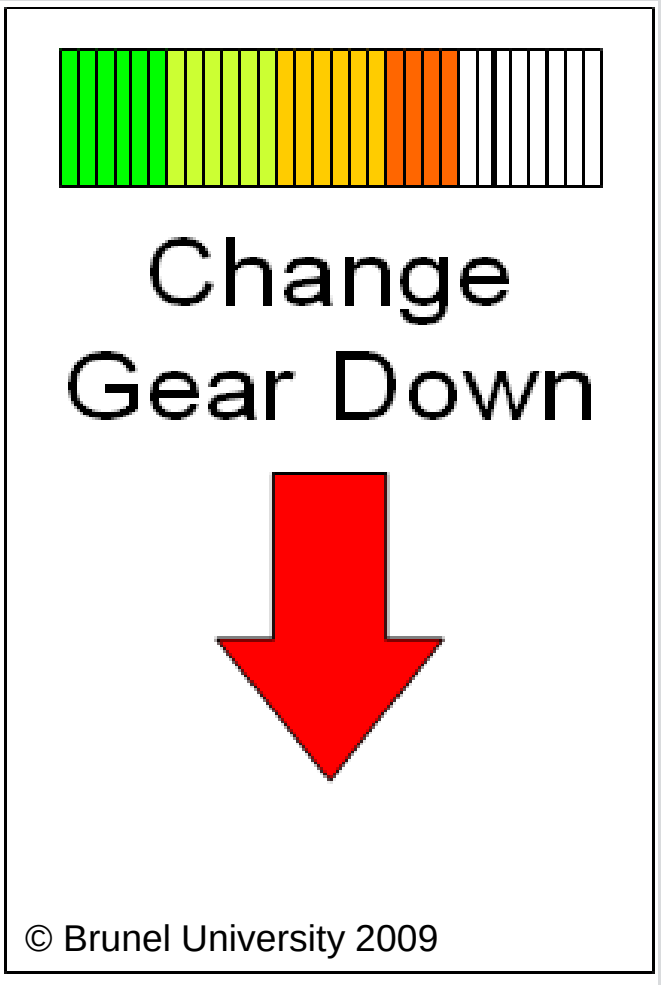
EID Interface



- Ecological Interface Design Principles
- Dynamically reflects driving environment
- Integrates information
- Direct perception

Dash Board Interface

- More conventional Dash Board (DB)
- Best practices
- Warning icons and textual information
- Shows one parameter at any one time



Aims and Objectives

- Impact that smart driving aids have on driving performance and distraction
- Which interface performed better
  - Distraction, workload & driving performance
- Brunel University Driving Simulator

Methods

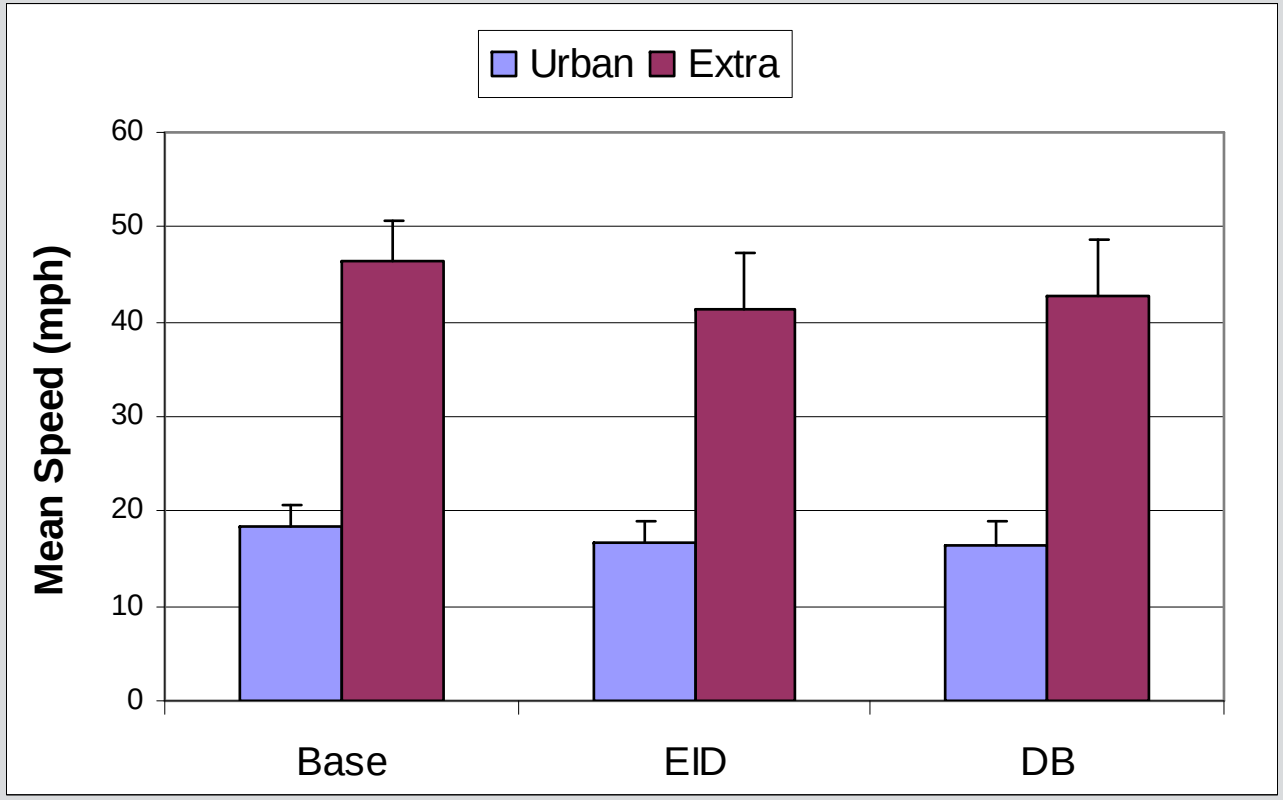
- 25 Participants
  - 11 male 14 female; age 35.2 years (± 8.7)
- Two driving cycles (urban & extra-urban)
- Three conditions (Baseline, EID & DB)

Dependent Variables

- Primary Task (driving) Performance
  - Mean speed & lane position, violations
- Secondary Task Analysis - PDT
  - Mean response time, n of correct responses
- Subjective Measures of Performance
  - NASA-TLX & DALI

Primary Task Performance

- Feedback conditions resulted in decrease in mean driving speed in both scenarios

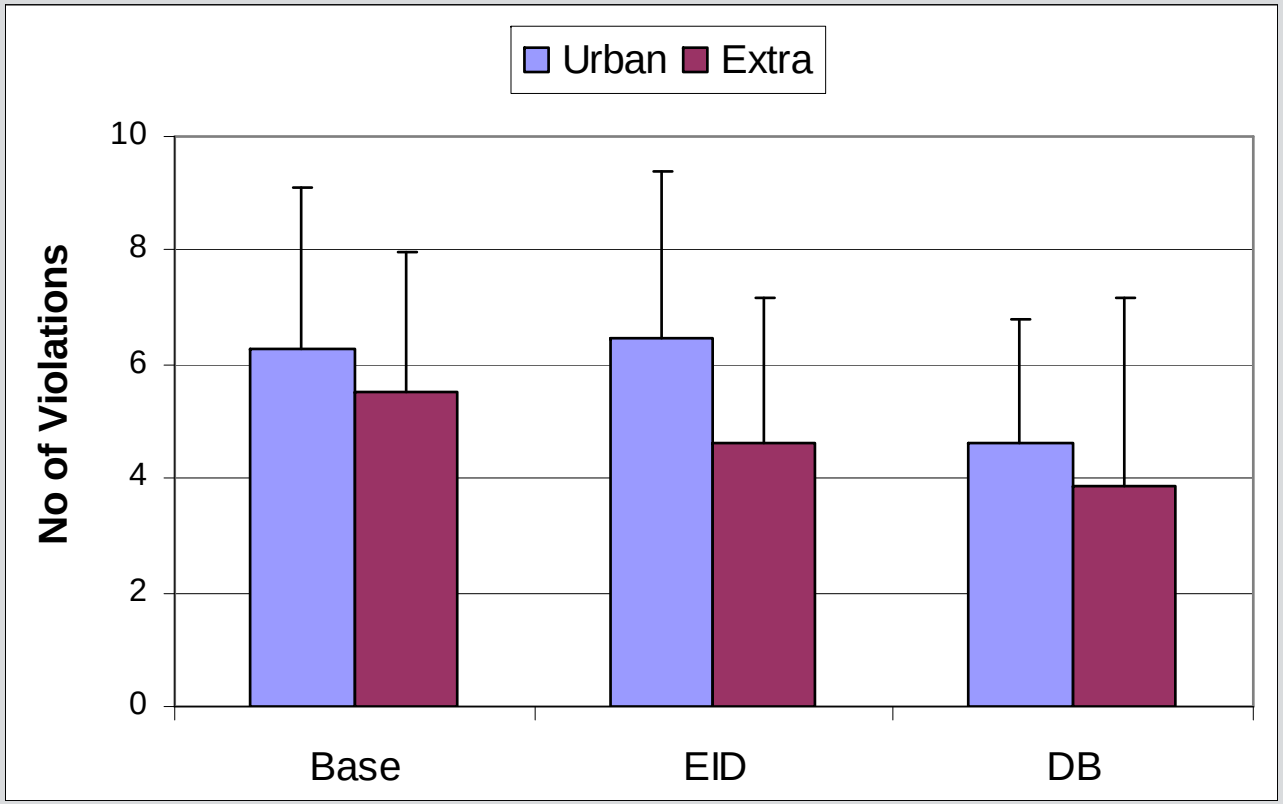


Mean Driving Speed

- Decrease in driving speed is generally perceived as a positive outcome
  - Decrease number & severity of accidents
  - Increase fuel consumption
- Can be as a result of distracted drivers
- No difference between EID and DB

Primary Task Performance

- Significant main effect for number of violations in both urban and extra-urban driving scenarios

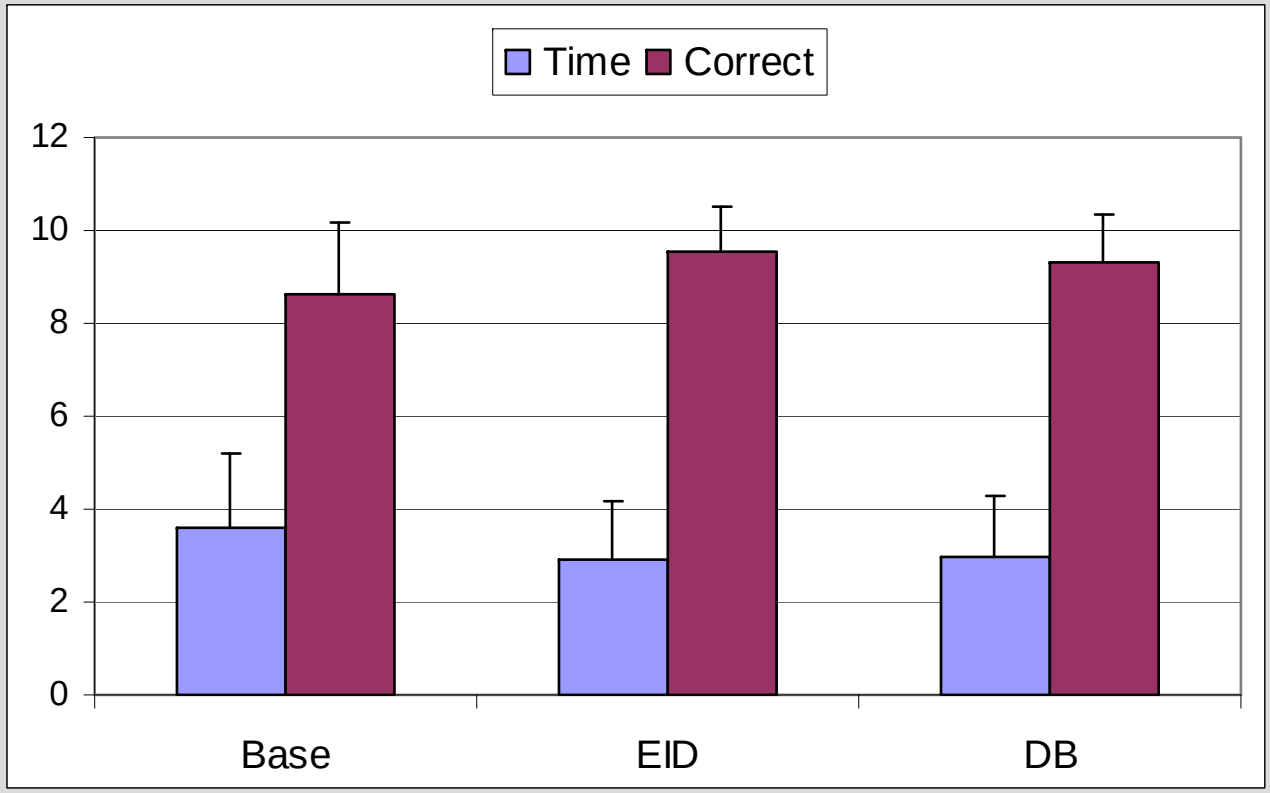


Number of Violations

- High number of violations for EID in urban
- No difference in % time spent over speed limit between EID and DB conditions
- No difference in mean lane position

Secondary Task Analysis

- EID gave highest number of correct responses, and trend for fastest response in urban cycle



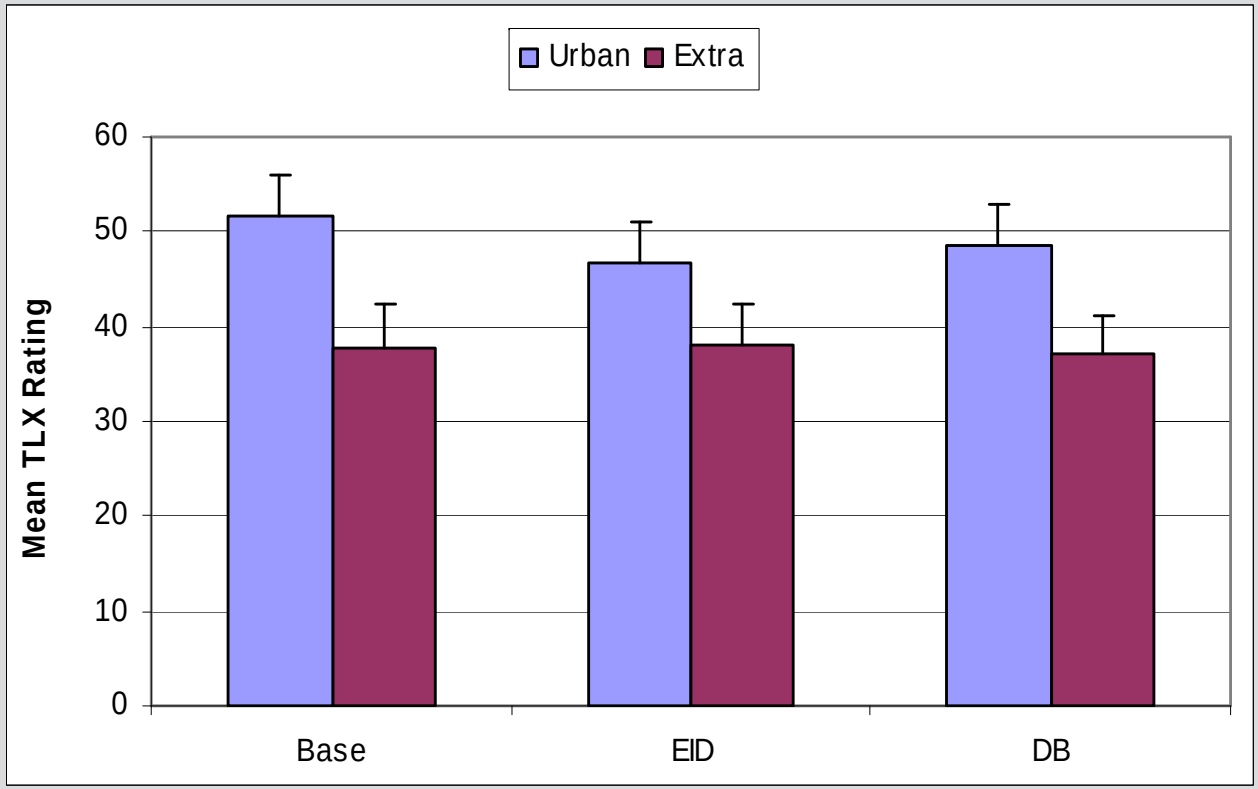
PDT

- Improved performance in PDT in feedback conditions, particularly with EID
  - Learning effect?
  - Reduced driving speed?
  - Increased visual scanning?

- No difference between interface designs
- No difference between any condition in the extra-urban driving scenario

Subjective Measures

- TLX ratings did not differ between conditions for either driving cycle



TLX Questionnaire

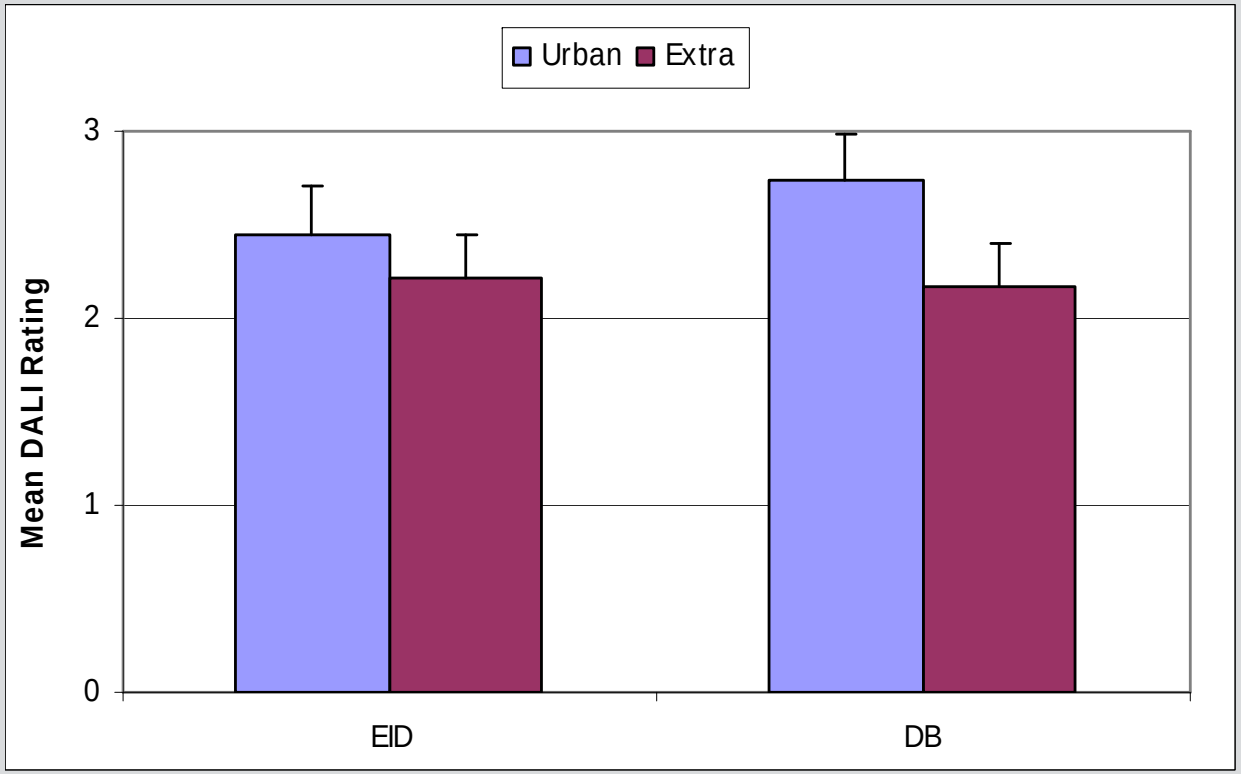
- Lack of difference with TLX has been seen previously (Jahn et al, 2005)
  - May suggest TLX not suitable for evaluating between two interfaces
  - Does reveal differences with task complexity
- Suggests smart driving feedback did not increase driver workload

Subjective Measures

- Driver Activity Load Index (DALI)
- Based on TLX
- Specifically developed to evaluate IVIS during driving
- Includes factors such as:
  - Auditory Demand and Interference

DALI

- EID rated significantly lower workload than DB in the urban cycle



Conclusions – 1

- Smart driving feedback delivered through an in-vehicle HMI resulted in:
  - Decrease in mean driving speed with both simple and complex driving scenarios
  - Reduction in time spent over speed limit
  - No increase in driver subjective workload
  - No increase in driver distraction

Conclusions – 2

- Differences between two interface designs
  - No differences in driving performance or distraction measures
  - EID rated lower workload than DB using DALI
  - EID preferred in other subjective measures

Conclusions – 3

Real-time delivery of smart driving information did not increase workload or adversely affect driver distraction

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Questions?

Thank You For Listening

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