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Visual demand for maps at different scales of in-route guidance and navigation system

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INTRODUCTION

✓ **RGNS -** In-vehicle Route Guidance and Navigation Systems have the function to help drivers in navigation task

✓ Driving task requires a lot of concentration!

- Taking eyes off the road to receive information of a RGNS may have serious impacts on traffic safety

✓ Designers have pointed out the importance of usability issues of RGNS

✓ To design maps for RGNS with high usability many variables are involved

→ Scale map selection

INTRODUCTION

Goal:

✓ Evaluate drivers' visual demand for maps at different scales to perform simple and complex maneuver using RGNS

✓ Visual demand was quantified in terms of:

- Number of glances for the maps
- Minimum duration of glances
- Mean duration of glances

METHOD

Participants

✓ 52 drivers (26 males and 26 females)

- Age between 21 and 38 years old (mean = 28.05; SD = 4.62)
- Participated voluntarily of a simulated experiment

✓ Subjects were required to be:

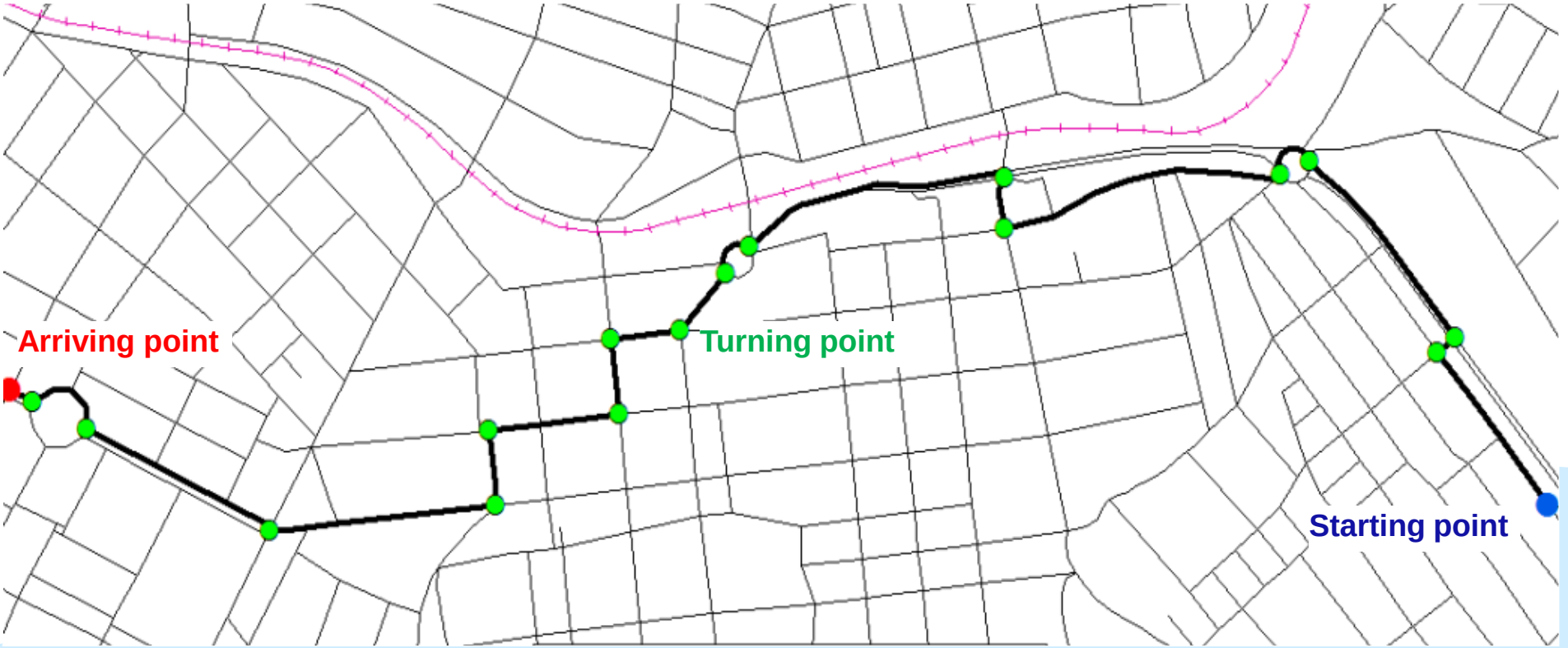
- regular drivers for at least two years
- having no or little knowledge with experimental route
- having normal color vision

METHOD

Experimental route

✓ Total length of 3.4 km

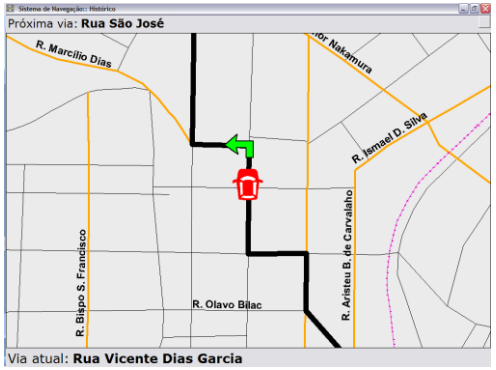
✓13 maneuvers classified as simple or complex (roundabouts)

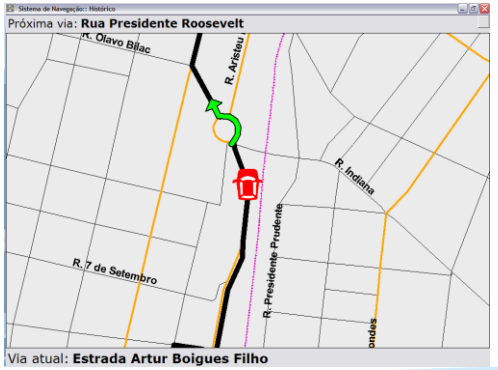


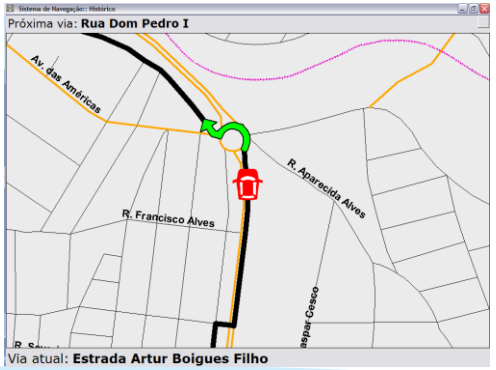
METHOD

Cartographic representations

1:3,000







1:6,000

✓Cartographic representations were developed in a RGNS prototype by using ESRI MapObjects with Microsoft Visual Basic

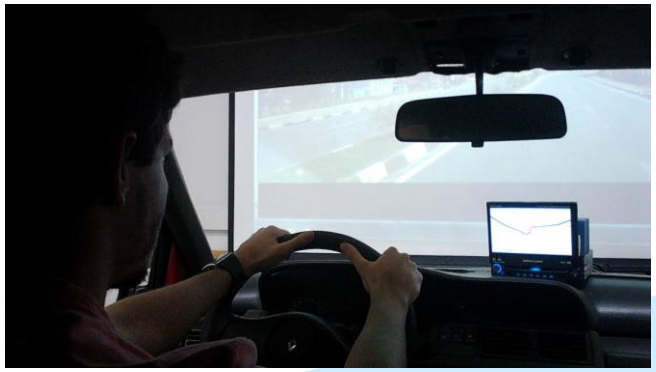
METHOD

Driving simulator

✓ The experiment was performed in a low-cost and fixed-base driving simulator

A car;

A large screen-image (180 cm height and 240 cm width) to display the video movie of the road test;



7-inch LCD screen placed on the dashboard to display maps of RGNS

METHOD

Procedure

✓ Drivers were divided into 2 groups of 13 males and 13 females

- To change the presentation order of map scale

✓ Before starting the driving simulation task, drivers were :

- familiarized with the simulator
- familiarized with the cartographic representations
- asked to read test description
- asked to complete a questionnaire of individual characterization
- asked to sign the consent form

METHOD

Procedure

✓ For driving simulation task, drivers were:

- required to suppose that they should be navigating by car in an unknown town using a RGNS
- advised to pay the necessary attention to the video movie to avoid traffic accidents
- asked to look at the navigation display using quick glances to get map information presented by the RGNS

✓ **The drivers' visual demand was recorded using a Tablet of 7-inches**

RESULTS

Statistical analyses

- ✓ SPSS 16.0 (Statistical Package for the Social Sciences Software)
- ✓ A confidence level of 95% was used for all statistical analyses

- ✓ Comparison of visual demand among different maneuvers was focused on the 11s before the maneuver point which corresponded to tactical task time

RESULTS

1:3000 x 1:6000

- ✓ To simple maneuver there is no difference between maps;
- ✓ To complex maneuver, results show that both the number of glances ($p<0.0001$) and the minimum duration of glances ($p<0.0001$) were higher when a more detailed map (1:3,000) was used.

Males x Females

- ✓ Women looked at the maps more frequently than men to perform simple maneuver, in spite of map scale 1:3,000 ($p=0.008$) or 1:6,000 ($p=0.071$)

CONCLUSIONS

✓ Drivers had better performance in complex maneuver when they were instructed by a more generalized map (1:6,000)

- Probably because maps can support drivers to identify the direction of maneuver and to get surrounding information of the route as well

✓ In the studies cases, the cartographic communication performance depended on the scale selected for maps, especially in complex maneuvers

✓ We also conclude that gender is an important issue to be considered at map scale selection

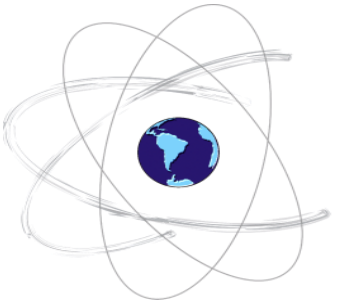
✓ Drivers seem more confident to read and comprehend maps when they establish a proper relationship between spatial information about route and maneuver's details

RECOMENDATIONS

- ✓ We suggest to explore deeper the relationship between drivers' performance and their gender

- ✓ We also recommend to associate visual demand with other objective and subjective measures to estimate drivers' mental workload when they navigate and use RGNS

ACKNOWLEDGMENTS



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