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A PRELIMINARY CARTOGRAPHIC DESIGN OF AUTOMATICS MULTI-SCALE AND AUDIO-DYNAMIC MAP FOR IN-CAR ROUTE GUIDANCE AND NAVIGATION SYSTEM

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A small number of studies about the employment of generalization in designing cartographic representations has been found. However, the use of commercial navigation systems has been increasingly disseminated in the world. Researchers have shown that type and quantity of information presented in maps of In-Car Route Guidance and Navigation System (RGNS) have a direct impact on performance of the system. For instance, maps presenting more information than the necessary may confuse the driver. On the other hand, lack of required information could negatively affect decision making. Some important issues concerned to cartographic design of RGNS need to be considered, such as the small size of the display and different amount of information for route following. Thus, maps in different scales have been presented in small devices to help drivers in navigation tasks. This study presents a preliminary design and production of automatics multi-scale and audio-dynamic map for RGNS, based on cartographic communication principles. The system presents a map display in heading-up orientation and orthogonal view. The design was divided in two stages: general composition and auditory-graphic design. The first one is concerned to selection of geographic area, media, scale and type of information, which are associated to map tasks. These map tasks were established to help drivers in route following. A small town located in Sao Paulo state, Alvares Machado was chosen for this work. The route selected presents different types of roads, nodes, maneuvers and two speed limits (between 40 and 60 km/h). A small-screen LCD display, seven-inch monitor, was used to present the maps. Information like car, route, direction arrow, road network, landmarks and street name was selected to create the visual representation. These elements provide information about driver's position, next maneuver and spatial context, which have been judged as the most useful by drivers when following a route. For that route, it was adopted four different scales 1:10000, 1:5000, 1:2500 and 1:1000, which are automatically changed by the system for accomplish the tactical task. The automatic multi-scale solution was written in a navigation system, which was developed recently in the Faculty of Sciences and Technology. A total of four important issues related to map scale were taken into account, such as screen size of the mobile device, distance to the next maneuver, speed limit of the road, and navigation task. These maps were resulted from an accurate cartographic database at scale 1:1000 by applying generalization techniques, such as selection, simplification, displacement, and enhancement. Car, route and road network symbols are always visible in the map, for all scales. Since drivers tend to reduce their speed when they are near from the next maneuver, landmarks, street name, and direction arrow are presented in the intermediate scales 1:5000, 1:2500 and 1:1000. Related to auditory-graphic design, the vehicle and arrows are symbolized in red color, with the goal of creating a unity with both elements. Moreover, the static car symbol was centered in the map, vertical and horizontally. To establish a visual hierarchy, route and road network are presented with different thickness. The auditory information is presented in scales 1:2500 and 1:1000 and the voice messages like "Turn right, at Avenue Americas" or "Turn right, at church" were recorded with a female voice. They were preceded by a beep to get attention of the driver to receive aural information. In order to propose guidelines, which can contribute to the improvement of commercial systems, the system performance will be evaluated in the future by using human factors and ergonomics methods. The evaluation will take into an account a group of variables to measure the visual demand, mental workload, subjective preference and navigational errors.