

# User Experience with in-car GPS Navigation Systems: Comparing the Young and Elderly Drivers

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## ABSTRACT

This paper outlines the design requirements of a GPS car navigation system for the elderly and the young by proposing a set of new guidelines for designing such systems. Our study revealed that younger drivers had a more positive user experience as compared to the elderly drivers. This paper also identifies a number of advanced features that a routing system should have for satisfying both the elderly and younger drivers on road. In conclusion, we will discuss the key design recommendations that were derived from the study.

## Categories and Subject Descriptors

H.5.2: User Interfaces – *user centered design, prototyping, evaluation/methodology*

## General Terms

Design, Experimentation, Human Factors.

## Keywords

Elderly, GPS navigation system, Young, User experience

## 1. INTRODUCTION

The advancements in mobile technology are known to all. Mobile devices are proliferating in all domains, for e.g. health care, telecommunication etc. An after effect of this has been the swift deployment of navigation aids built on top of mobile technology. Of course this progress and growth has also been rendered possible by the initiation of the Global Positioning System (GPS). Now, users have access to route information that lets them maneuver themselves with ease whether in their car, bike, or even just walking. However, there is not much recent literature where user experience is formally evaluated for GPS car navigation systems. One example can be found in [3]. Moreover, since GPS navigation systems have advanced in recent years the findings of such surveys need to be reevaluated. Therefore, it is worth investigating the role current in-car GPS navigation system play in the overall driving experience of drivers, across two important age groups: the young and the elderly. Firstly, we wished to

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quantify how well current GPS systems satisfy user needs; secondly we aimed to investigate if there was any difference of user experience between the two groups and lastly our comparison was aimed to provide design requirements for car navigation aids for a particular user group amongst users.

## 1.1 Measuring User Satisfaction

To ascertain the user experience with respect to navigation systems we conducted a survey amongst young and elderly drivers who had used or were using GPS devices from TomTom [4]. Potential participants were contacted by email or in person. The important requirement was that users must have some experience with using navigation systems. In total we received reactions from nine young participants ( 5 male and 4 female, age range 18-32, driving experience 2-14 years, and GPS experience 0.25-5 years) and six elderly participants ( 3 male and 3 female, age range 65-69, driving experience 15-40, and GPS experience 1-4 years). All participants used various versions of the TomTom Navigation system [4] as their GPS device.

Participants were asked to fill out a product evaluation questionnaire in reference to the GPS system that they owned. The main part of the survey was a simple questionnaire extracted and modified from the Product Evaluation framework [1]. The 14 Likert scale items ranged from 1-5 and tested various aspects of product use, such as “I feel stimulated by using this product”, “I rely on this product” etc. Besides quantitative measurements, participants were also required to fill in qualitative remarks dealing with general comments, preferences, pros and cons and recommendations to improve their user experience with the GPS device; all in respect to their own GPS device.

### 1.1.1 Results

Young users generally had a more positive association and experience with GPS systems as compared to the elderly. This is clearly evident from the bar chart that we drawn out for some selected questionnaire items. We performed the Mann Whitney non parametric test on the questionnaire data. As is evident from the bar chart Fig 1 presented, subjectively rated reliability was significant ( $u = 8.5$ ,  $p = .042$ ) with the young users rating their experience much more positively. Young users also rated relaxation significantly more positively ( $u = 7$ ,  $p = .032$ ). Confidence was close to significance ( $u = 10.5$ ,  $p = .058$ ).

However, overall, there was not much difference between the user experience of the young and the elderly. But the sample size that

the survey was conducted in was not very large, so caution must be extended while interpreting our quantitative results. Nevertheless, upon analyzing the qualitative feedback, it is clear that we have discovered important usability issues that were uncovered even though the sample size was small.

The elderly were cautious about blindly trusting the advice of the GPS system. As is indicated by the following written quote from one of the elderly users: “...If you exactly follow the TomTom you can do a mistake, you need your own judgment...”. This is in line with the quantitative results obtained, as the young users gave an overall higher ranking on reliability. Such particular trends also extended to confidence and to relaxation. The elderly users at times felt that the information provided by the GPS device was not fully correct (according to their own perception) which meant that they did not feel fully relaxed. This relates back to the fact that in such situations the elderly would fall back on using their own judgment. Based on the qualitative feedback we ascertained that; the elderly would get confused when the GPS device would suggest an unknown or uncommon route, although it would not be incorrect in the true sense but the elderly would perceive it to be as the wrong route. This line of reasoning was extracted from the following quote: “...sometimes it gives me a different route (not the one which I know or use)...”. Another interesting problem that the elderly faced was that at times they were burdened by the amount of instructions given by the GPS device. As was said by one of the elderly: “...(Sometimes) it also gives too many instruction at one time which I usually forget...”

The young users expressed a desire of having balanced feedback and pointed out various scenarios when the feedback was too little or just too overwhelming. Similarly, the young users were disturbed when the GPS device would give no indication when they were going on the right path towards their final destination, for e.g. on the highway it would remain silent for several kilometers. In contrast, the system would provide extra feedback in cases such as when a driver would knowingly not follow the suggested route the GPS would annoyingly beep and repeat the instruction to turn around. Even though the young users gave a significantly higher ranking on the item of reliability, they realized that they there was a tendency to get over dependent on their GPS device. This can be acknowledged from the following comment: “...After using it (GPS device) for a while, if you don't have it, it gives me an uncomfortable feeling...”. Both young and elderly pointed out that they faced problems in road turns and roundabouts while navigating with the GPS system.

In addition, both user groups admitted that at times the feedback from the GPS was excessive leading to annoyance. This was especially the case when taking wrong turns. One of the elderly drivers stated: “...On taking a wrong turn, sometimes TomTom gets confused and always says go back go back...”. Both user groups expressed having problems regarding lane guidance from the GPS system. The issue was compounded for both elderly and young users when they would use the GPS for the first few times, consequently leading them to misinterpret the identity of the correct lane.

## 2. DESIGN RECOMMENDATIONS AND CONCLUSION

A GPS device should cater for easier interaction while driving as it is not safe to interact with the GPS while driving.

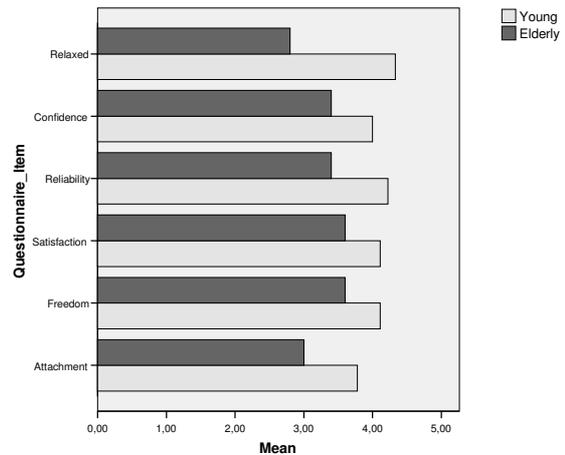


Fig 1. Mean ratings of major items from questionnaire, young vs. elderly

Adaptive characteristics of the navigation system would be helpful in this regard for e.g. supporting interaction via speech commands. However, such interaction would of course have to be evaluated as speech recognition can be problematic. Another recommendation was to provide balanced feedback at the opportune moment especially for elderly people; normally feedback from GPS devices is both too early and repetitive or is too late. For such a case, the GPS device must be intelligent and understand the context. Additionally the GPS device can provide additional feedback when an alternate route is chosen, that would enhance the trust of the user with GPS navigation system. Customized view was a desired feature, depending on individual requirements and preferences. For e.g. in newer locations a more detailed view would be convenient. Customization would also be helpful to reduce the detail of information so that it is not overwhelming. Another interesting recommendation that was derived was to provide voice feedback in conjunction with point of interests and landmarks so that users will be more aware and attached with the environment while driving. A similar recommendation was also reported in [2].

In summary, we feel that there is an imperative need of providing a usable navigation system that is primarily tailored for the use of the general population, at the same time customized for specific target groups such as the elderly. We would like to implement and test some of the design recommendations that we have presented.

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