Social Driving Services: Very Cool, But How To Guarantee Application On Broad-Scale?

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Abstract
Social driving services are said to improve road safety, fuel economy or traffic fluidity and throughput, and results of diverse studies suggest that drivers are already willing to use such services when on the road. But for a general agenda on the application of social driving services, more closer attention need to be paid to the results – as they are often compiled from unrepresentative tech geeks, ignoring more problematic user groups such as persons in stressful jobs. These people use the time in the car as sort of “oasis of calm” for recovery, and would never accept constantly interrupting or disturbing apps.

Based on the qualitative results from a user study summarized in this paper, I would like to discuss in the workshop what are the main obstacles that could avoid the proliferation of social driving services on large scale and how to redesign these services to also convince the critics.

Author Keywords
Social driving services; User experience; Autonomous cars; Individuality.

ACM Classification Keywords
Human-centered computing: [Human computer interaction (HCI)]: HCI theory, concepts and models.
Vehicle passenger cabin: Gambling house versus oasis of calm?
Many drivers spend a reasonable time for commuting each day in their car, and most of the drivers use their car alone – according to a recent study, car occupation in commuter traffic in Europe has fall below 1.2 passengers/vehicle [1] and US values are likewise (occupancy rate 2009: 1.13 [4]). While one group of drivers (mainly the younger people) demand ever-wider entertainment options, there is another growing group (mainly older people and persons in stressful (management) positions) that use the single occupancy time in the car (to/from workplace) as sort of “oasis of calm” for recreation, relaxation, resting, recovery/regeneration and for going back over everything he/she did during the past day. The latter group would never accept to share the car with anybody else, nor to connect to social services that demand attention or active participation. When thinking of global car networks, these two parties clash as polar opposites, but must nonetheless appear together to tackle all the dynamic challenges in traffic.

Field test using a “social driving app”
To get a deeper understanding about the personal opinion of current drivers on social-related car services, we conducted a field operational test (FOT) using a “Social driving app” providing inexperienced drivers or drivers unfamiliar with a certain route recommendations about how to drive on that track in an optimal way. The optimal line of driving (“driving profile”, incorporating driving speed, braking/acceleration forces, gear to engage) were collected from expert drivers with high yearly mileage and experience on/familiarity with that route. These parameters were forwarded to a web service, processed, and recommendations finally generated via the “Social driving app” for the less competent drivers. The technical aim of this project was to substantiate that the “Social driving app” has the potential to improve fuel economy as well as driving safety. By introducing a ranking system to motivate the individual drivers to follow the instructions from the system, and, thus, to drive “better”, we further examined the influence of social aspects in car collectives. To test the feasibility of the “Social driving app”, a field operational test (between-groups design) was performed on a federal highway (route length ca. 22km) and under realistic conditions (e.g., with oncoming traffic and cars running ahead). 9 male subjects aged 23-26 years agreed to participate in the study. Baseline data (used for the recommendations) was collected by drivers familiar with the test track, control group drivers without prior knowledge of the test track had to complete a driving task without any recommendations, test group drivers received driving instructions or recommendations from a social app/companion while passing through the same route [3]. The small-scale field study could not confirm our hypotheses that using the app actually reduces fuel consumption or increases throughput, traffic fluidity and road safety. Nevertheless, a subjective analysis conducted along with the main study gained some interesting results – which will be summarized in the following and discussed on a broader scale afterwards.

Current drivers: Positive attitudes toward social assistance
In general, questionnaire results revealed that most of the drivers liked the recommendation system and they thought that they actually drove better (than the control group without the recommendation system). They further mentioned that they would like to have such a system in the future in their own cars. It should be mentioned that a larger test with more participants and/or a longitudinal test on a blocked road (e.g. race course) should be run to get more meaningful results for both, quantitative as well as qualitative data.
Subjective assessment
The NASA TLX was used as a subjective assessment tool to rate the perceived workload of subjects to assess the efficiency or other performance aspects of the “Social driving app”. Each of the 6 tasks of the TLX were rated on a 20-level Likert scale (1...low demand, 20...high demand). The evaluation of the NASA TLX workload test results in an average score of 10.55 for all drivers of the test group, which corresponds to medium demand and suggests that the subjects had no big issues in receiving recommendations from the Android application (“Social driving app”). No further peculiarities were found in the returned questionnaires regarding TLX.

Sixteen non-workload related questions were fragmented into four groups, 1) audio feedback (5 questions), 2) visual feedback (4 questions), 3) usability aspects (4 questions), and 4) privacy issues (3 questions). Respondents had to rate 11 of the questions on a 7-level Likert scale (1..don’t agree, 7..fully agree), the remaining 5 questions allowed for free text answers. In the following, only interesting/significant findings are discussed.

1) Audio feedback
In general, participants were not annoyed by the auditory feedback (“Was the audio feedback annoying?”, avg. score=2.33). By receiving an “applause” sound for achieving top rank in actual fuel consumption, they felt confirmed with their driving behavior (“Did you feel confirmed in your driving behavior by receiving the ‘applause’ sound?”, score=6.0) while the “puuuh” sound encouraged them to actively drive “better” (“Was the ‘puuuh’ sound responsible for you to change your driving behavior?”, score=5.66). This finding is pretty obvious for a systematic user study, but needs further investigation in longitudinal studies (e.g., to test situations in which the driver forgot that he/she is monitored).

2) Visual feedback
According to evaluation results, users thought that the visual feedback/recommendations were quite useful (“Do you think the feedback system was useful?”, avg. score=6.66) and visual feedback did not distract them from the primary task (“Did you feel distracted from the main task (steering)?”, score=2.0; “Was the display content clearly visible and well arranged?”, score=6.33). Test participants also indicated that they did change their driving behavior because of the feedback of the “Social driving app” (“Did you change your driving behavior/style due to the received visual feedback?”, score=6.0). According to driving data analysis, the reported behavior change has not caused significant changes in driving trajectories. This might be due to the low number of subjects, or varying traffic conditions on the road between different runs (no blocked road).

3) Usability aspects
For the questions related to the usability of the “Social driving app”, user feedback was in general very positive. Most of the users indicated that they find such a system really useful (“Do you think such a service would be useful for real driving?”, score=6.67) and that they would like to have such a system in the future in their cars (“Would you like to have this kind of interface/service in your future car”, score=6.33). Regarding the question if participants of the test group think that they drove better than the control group without the driving recommendations, they responded with a clear “Yes” (score=6.0).

4) Privacy issues
In general, subjects had no concerns about privacy, only one test participants mentioned that he would only use the system if the data is transmitted and stored anonymized. This is not at all a problem for the current service, as the “Social driving app” is never collecting
personal information from a driver, but could be an issue in the future, with many new personalized services emerging that request and share personal data.

Discussion
By merging all the information from drivers, cars, and infrastructure into a common database, the basis for an improved interaction and optimization, based on similarities from biology (pheromones, stigmergy [2]), etc., between the involved parties could be established.

Looking at the results of this first and small-scale field test on the applicability of social driving services, it seems that people are already “ready” and willing to use such add-ons in actual driving. But these initial findings have to be taken with care – as for the current study only young male people (aged 23 to 26 years) were invited to participate (homogeneity). This group matches exactly with the first group mentioned in the introduction, and, thus, the results are not surprising. The other, more reluctant and pessimistic group was fully omitted in the current study and it would have been of high interest, how a group of managers or salesman would have performed in the field trials and responded to the posed questions. As the system is not only intended for commuter traffic, also the group of persons with stressful jobs might want to use the system for leisure or vacation travel. This could be automatized, for example, by taking the schedule of the driver or measure his/her physiological condition.

The whole discussion would result in even more problems if also driverless cars are transiting on our roads. They have to include this “social behavior” (negotiation, experience sharing, conflict resolution, etc.) per definition, but are not really social agents and might interfere with drivers of manual steered cars (with or without an enabled social service client).

Conclusion
The qualitative evaluation of a field study using a social driving app has shown a high potential for its application (at least for the younger, open-minded drivers). However, a number of factors might be around that hinders or avoids the application of social services in the car on a larger scale. Nevertheless, I see social driving services, like the one presented in this work, as absolutely needed for the future of individual traffic. Therefore, I would like to discuss in the workshop a) what are these potential factors, and b) how to redesign social car services to convince the critics and allow for its proliferation on large scale.

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References