

The inclination of university students towards carpooling: critical aspects and opportunities

MARIANO GALLO, CHIARA BUONOCORE

Department of Engineering

University of Sannio

piazza Roma 21, 82100, Benevento

ITALY

gallo@unisannio.it, chiarabuonocore91@gmail.com

Abstract: In this paper the inclination of university students towards carpooling is explored by means of a survey; the survey was dispensed to the students of University of Sannio and questioned about the mobility for university trips and the availability to share the trip. The paper describes the reference context and the design of survey; then, the results of the survey are summarised and discussed. Main findings showed a good inclination towards carpooling with known students (over 90% of respondents) while to travel with unknown students is still a problem (the percentage drops to about 60%). Similar results were found for other kinds of trip, where to travel also with a known person is the principal condition for using the carpooling on long distances. Therefore, the survey identifies as main barrier to carpooling diffusion the mistrust towards sharing trips with unknown people, also for young, social-inclined and cultured people.

Key-Words: - Carpooling, ride sharing, sustainable mobility, university

1 Introduction

The carpooling is a well-known and diffused transportation mode where some people share the trip and, sometime, its monetary costs using the car of one of them; this mode is significantly diffused among work colleagues and university students and its main objective is to save trip costs. Promoting the carpooling is also considered a possible transport policy to reduce congestion and environmental impacts of road transport; indeed, the increase of car occupancy rate may lead to a reduction of traffic flows without reducing the overall mobility and/or increasing the operation costs of transit systems. Some policies to promote carpooling are based on incentives for users as HOV reserved lanes, free parking, etc.

Usually, the carpooling is organised among people that know each other; recently, thanks to diffusion of internet and mobile personal devices (smartphone, tablets, etc.), several web-based services allow to organise carpooling with unknown people (blablacar, avacar, carpooling, bringme, roadsharing, etc.).

In the literature, several papers focused on carpooling or ride sharing; the two terms often are assumed with the same meaning, but sometimes the term “ride sharing” is adopted for indicating when some passengers are collected along the trip (not

from the origin of the driver) and are leaved not necessarily at the final destination of the driver. In the following, we will consider equivalent the terms “carpooling” and “ride sharing”, referring to all cases of shared trip. Cho *et al.* [1] formulated an agent-based interaction model for carpooling; a method for managing the dynamic carpooling based on a multi-agent system was proposed in [2]; Bicocchi and Mamei [3] investigated the ride sharing opportunities examining mobility data; in [4] a model for defining a common route for carpoolers is proposed; the simulation of individual mobility behaviour in carpooling has been studied in [5]; a web-based global carpooling matching service was proposed in [6]; the stochastic aspects of carpooling were studied in [7].

The main barriers to the diffusion of carpooling are related to the mistrust to travel with an unknown person, especially for women, the reduction of freedom (in choosing starting time, path, etc.) and of privacy; on the other hand, travelling not lonely can be seen as an important incentive on long distances also from the point of view of safety as well cost saving.

University students are probably the class of users more inclined towards carpooling for several reasons: the age, the culture, the use of internet, the “social” attitude, the need to save money, etc. In

particular, the carpooling is a valid alternative for trips towards and from the campus, as well for other non-systematic trips.

In this paper we summarise the results of a survey dispensed to a sample of university students at University of Sannio (Italy); the survey was designed to explore the inclination of students to use the carpooling for home-university trips and for other trips.

The paper is organised as follows: section 2 describes the general context and the design of the survey; section 3 reports the main results of the surveys; section 4 concludes the paper.

2 Context and survey design

University of Sannio is located in the city of Benevento, in southern Italy; the university offers both B.Sc. and M.Sc. degrees in three departments: engineering; law, economics, management and quantitative methods; sciences and technologies. Overall, 20 degree programs are provided and the students are about 6,000. All university buildings are located in the city historical centre or close to it and can be reached within pedestrian distances from rail stations and bus terminal or with urban bus lines (see Fig. 1). The economic impact of the university on the city is very significant; indeed, only about 1,000 students live in Benevento, while the others 5,000 come from outside the city that has about 61,000 inhabitants.

A critical point of the University is the low accessibility of the city of Benevento with transit systems from the towns of the surrounding territory; indeed, only along some corridors, where railway services are available, the transit systems are actually useful for the students. Many towns are linked with Benevento with very low frequency bus lines and some others are not directly linked but only with transfers. This situation is due to two main reasons: (a) low investments in transit systems; (b) low-density territory that does not encourage the development of an efficient and effective transit network.

In this context, the carpooling may be seen as a good transportation alternative for improving the accessibility and could be promoted by the University with dedicated information campaigns, incentives for carpoolers (e.g. free parking, reduction of University taxes, etc.). Therefore, in order to explore the inclination of students to use the carpooling, as driver and/or as passenger, we organised and carried out a sample survey. A survey

card was designed; it was anonymous and presented three main parts: 1) general information; 2) home-university trip information; 3) inclination to carpooling. The survey card was organised so to be sufficiently short (only 2 A4 pages and 25 questions, for an averaging compiling time between 3 and 5 minutes) and so that the main part of it is destined to exploring the inclination of the student to carpooling.

The first part questions personal data of the student (age and sex), provenience (residence), car availability and driving licence, frequency of car use, use of smartphone for web and expertise in informatics devices.

The second part questions only about the more used mode for reaching the university and the frequency of the trip.

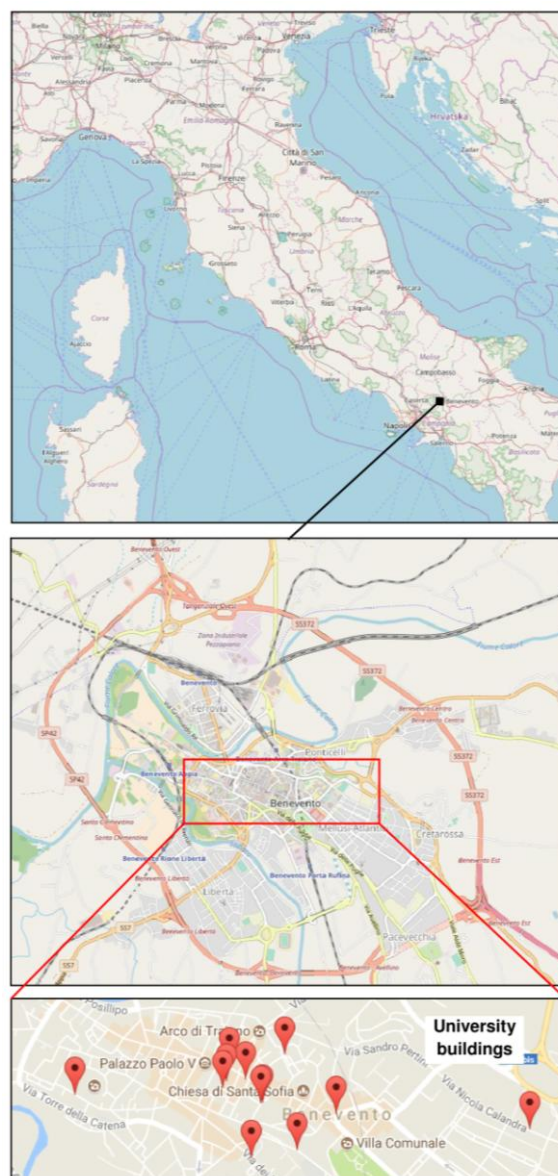


Fig. 1 - Location.

The third part is the core of the survey and questions the inclination of the students for carpooling; the questions regard:

- availability to share the trip with other university students using the own car; the questions are actually two: with known students and with unknown students;
- availability to share the trip with other university students requesting a passage; also in this case the questions are two: with known students and with unknown students;
- availability to share the trip from Benevento to some important cities (Naples, Rome and Milan) by offering or requesting a ride (six versions of the card were prepared, from A to F);
- utilization of smart phone apps or web services for sharing car trips and corresponding judgements on the experience;
- availability to use in the future smart phone apps or web services for searching fellow travellers.

In Fig. 2 a survey card is reported as example (the original survey card was in Italian).

3 Results of the survey

The survey was distributed to 209 frequenting students at University of Sannio, corresponding to a sample rate equal to 3.5%; each student was directly interviewed and the answers were registered on the survey card. The main results of the survey are summarised in the next subsections. The interviewed students were randomly chosen in the university buildings by the interviewer.

3.1 General data

Almost all interviewed students have the driver licence (95%) and car availability (91%); 52% have also an own car; the car availability rate is surprisingly high for university students, but this is due mainly to the scarce quantity and quality of transit supply in the area. Also the average car use frequency (for all trip purposes) is very high: 36% use the car every day; 34% between 4 and 6 days a week and only 30% less or equal to 3 days a week (see Fig. 3).

The diffusion of mobile devices is also (non-surprisingly) high: almost all (97%) use smartphones for surfing the web. All students use informatics tools; 29% consider to be advanced users, 67% normal users and only 3% poor user (see Fig. 4).

Fig. 2 - Survey card.

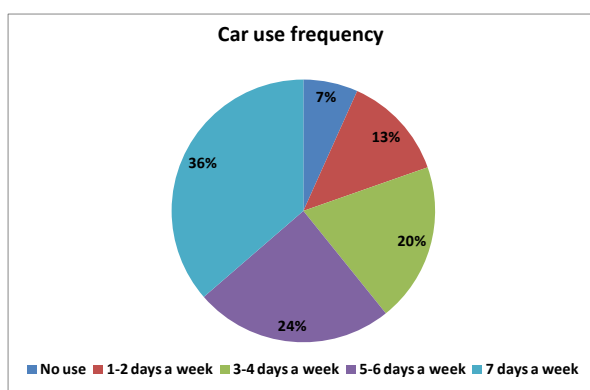


Fig. 3 - Car use frequency.

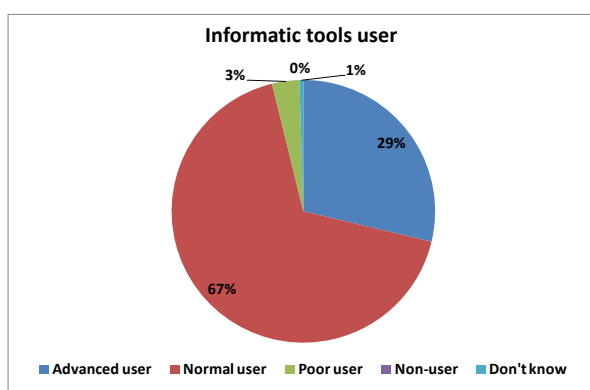


Fig. 4 - Informatics tools users.

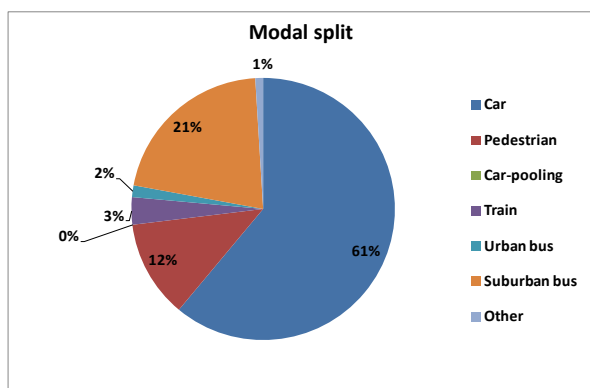


Fig. 5 - Modal split for home-university trips.

The inclination to use personal cars for home-university trips is confirmed by data on modal split (regarding the mode chosen for reaching the university the day of the interview): 61% used the car, 12% the pedestrian mode, 3% the railway, 2% the urban bus, 21% the suburban bus, 1% other (see Fig. 5). Note that no respondents declared that used the carpooling with other students for reaching the University the day of the interview. Among the car-users, 56% travelled alone, 20% together as driver and 24% together as passenger; comparing these results with the ones underlines that the students that

declared to travel non-lonely, have travelled with other (non-students) people (probably, family members). About the cars, 59% of cars were diesel, 31% gasoline and 10% other (mainly LPG). Finally, 5% of students used for returning to home a transportation mode different from the one used for the go trip.

Regarding the number of days spent at university, only 7% frequents the university from 0 to 2 days per week, 61% between 2 and 4 and 32% more than 4 days per week.

3.2 Inclination to use carpooling with other students

Second part of the survey questioned the inclination of students to use carpooling for travelling from home to university (and return); the questions were referred to 4 different situations:

- Q1) inclination to use carpooling, offering a ride in own car to “known” students;
- Q2) inclination to use carpooling, offering a ride in own car to “unknown” students;
- Q3) inclination to use carpooling, requesting a ride to a “known” student;
- Q4) inclination to use carpooling, requesting a ride to an “unknown” student.

For each question, the available answers were three:

- A1) no, under any circumstance;
- A2) yes, in any circumstance;
- A3) yes, conditioned (but only if...).

The proposed conditions (more than one response was possible) for the answer A3 were:

Cases Q1 and Q3:

- A3.1) ... if we share the monetary costs of the trip;
- A3.2) ... if they are reliable and punctual people;
- A3.3) ... if the path and the time schedules are the same.

Case Q2 and Q4:

- A3.1) ... if we share the monetary costs of the trip;
- A3.2) ... if also a known person travels with me;
- A3.3) ... if the path and the time schedules are the same.

Fig.6 summarises the answers to questions Q1-Q4. Note that the percentage of students that answered “no” increase dramatically from known students to unknown students (from 6.2% to 37.3% for offering a ride and from 7.7% to 41.1% for requesting a ride); another interesting result is that the “yes conditioned” are higher for offering a ride

with respect to for requesting a ride. In Fig. 7 the responses about the “yes conditioned” are summarised (since more than one response was possible, the sum of percentages is greater than 100%). Note that for offering a ride the condition more important is “same path and timetable”; sharing the costs is also important for about fifty per cent of respondents.

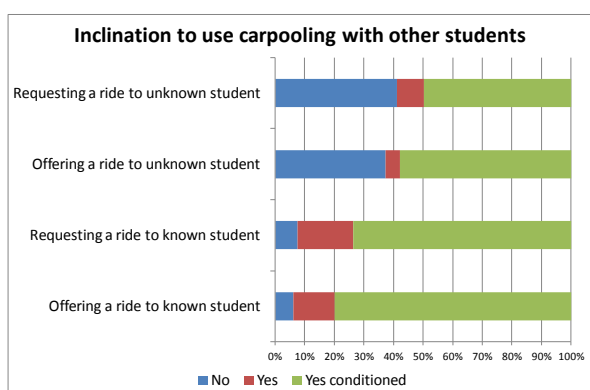


Fig. 6 - Inclination to use carpooling with other students.

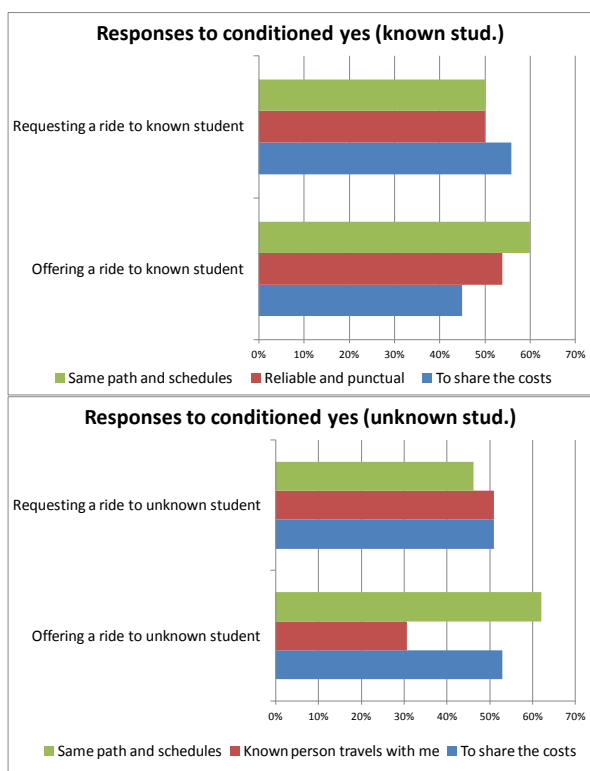


Fig. 7 - Responses about conditioned yes.

3.3 Inclination to use carpooling for other trips

In this part of the survey, the inclination of students to use the carpooling for other kinds of trips is explored.

A question regarded the inclination to use the carpooling for long distance travels; six different scenarios were defined (in each survey card only one of them is reported):

- S1) inclination to use carpooling offering a ride in own car from Benevento to Naples (98 kms, travel time 1h 15', monetary costs 20€);
- S2) inclination to use carpooling requesting a ride from Benevento to Naples (98 kms, travel time 1h 15', monetary costs 20€);
- S3) inclination to use carpooling offering a ride in own car from Benevento to Rome (233 kms, travel time 2h 30', monetary costs 40€);
- S4) inclination to use carpooling requesting a ride from Benevento to Rome (233 kms, travel time 2h 30', monetary costs 40€);
- S5) inclination to use carpooling offering a ride in own car from Benevento to Milan (790 kms, travel time 7h 30', monetary costs 140€);
- S6) inclination to use carpooling requesting a ride from Benevento to Milan (790 kms, travel time 7h 30', monetary costs 140€).

The possible responses were only “no, under any circumstance” and “yes, conditioned (but only if...)”, assuming that the “unconditioned yes” is not a possible response. If we group all responses for all scenarios we can see a good inclination to carpooling: only 10% of respondents said “no”; for the other 90% the response is a “conditioned yes”. In Fig. 8 are reported the data for all cases and the data for each destination: note that towards Naples, that is the nearest destination, the percentage of “no” is only 4%; it increases to 15% towards Rome and to 10% towards Milan. These data show a preference to use carpooling for short distances (where the travel time to be shared is not so long) and for long distances (where the saving in travel costs is significant).

As about the “conditioned yes”, the results are summarised in Fig. 9. We underline that most important condition is to travel also with a known person, while to share the costs and the positive feedback are less important for the user.

Other questions regarded the use of smartphone apps for sharing a trip with unknown people; 9% of interviewed students have already used a web-based carpooling service (more specifically, all have used blablacar) and have judged the experience very well (22% answered “very good”, 61% “good” and 17%

“not good neither bad”, no students gave a negative response).

The inclination to use apps and/or web services for the carpooling is also satisfying; indeed, only 8% are not available to use these tools, 33% do not have an opinion, 42% are inclined to use these services only if they are freeware while 17% could use them even if they are not freeware (see Fig. 10).

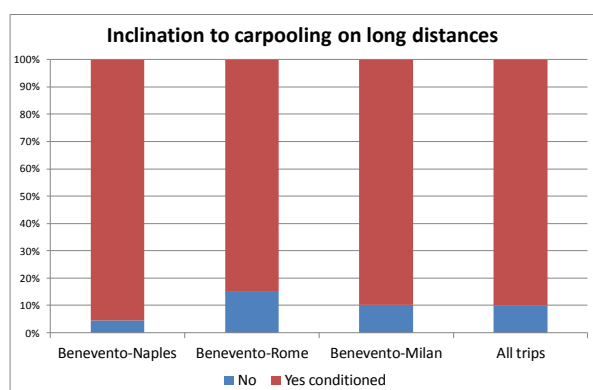


Fig. 8 - Inclination to carpooling on long distances.

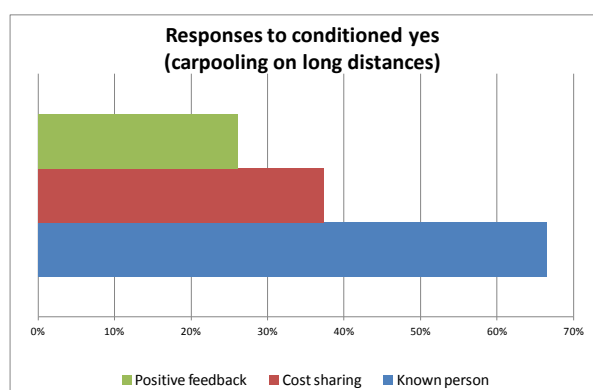


Fig. 9 - Responses to conditioned yes.

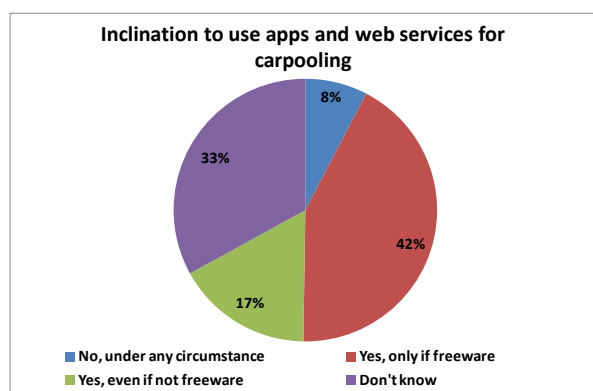


Fig. 10 - Inclination to use apps and web services..

4 Conclusions

The results of the survey have highlighted a good general inclination to use carpooling with other “known” students for university trips; the results are less promising with unknown students. Also for other kinds of trip, the presence of another known person is considered very important by the respondents.

Therefore, the main barrier to the diffusion of carpooling is the diffidence towards unknown people, also for young, “social-inclined” and cultured people. Indeed, the positive feedback (see Fig. 9) is considered less important than cost sharing and very less important respect to the presence of a known person in the car.

Future research will be addressed to study the possible incentives to carpooling for university students and the methods for removing the barriers to carpooling diffusion.

References:

- [1] Cho S., Yasar A., Knapen L., Bellemans T., Janssens D., Wets G., A Conceptual Design of an Agent-based Interaction Model for the Carpooling Application, *Procedia Computer Science*, Vol. 10, 2012, pp. 801-807.
- [2] Ben Cheikh S., Hammadi S., The Alliance between Optimization and Multi-Agent System for the Management oh the Dynamic Carpooling, *Advances in Intelligent System and Computing*, Vol. 296, 2014, pp 193-202.
- [3] Bicocchi N., Mamei M., Investigating ride sharing opportunities through mobility, *Pervasive and Mobile Computing*, Vol. 14, 2014, pp. 83–94.
- [4] Filcek G., Gasior D., Common Route Planning for Carpoolers – Model and Exact Algorithm, *Advances in Intelligent System and Computing*, Vol. 240, 2014, pp. 543-551.
- [5] Galland S., Knapen L., Yasar A., Gaud N., Janssens D., Lamotte O., Koukam A., Wets G., Multi-agent simulation of individual mobility behavior in carpooling, *Transportation Research Part C*, Vol. 45, 2014, pp. 83–98.
- [6] Knapen L., Arroyo Hartmanb I., Kerenc D., Yasara A., Choa S., Bellemansa T., Janssens D., Scalability issues in optimal assignment for carpooling, *Journal of Computer and System Sciences*, Vol. 81, 2015, pp. 568-584.
- [7] Yan S., Chen C. Y., Chang S. C., A Car Pooling Model and Solution Method With Stochastic Vehicle Travel Times, *IEEE transactions on intelligent transportation systems*, Vol. 15, 2014, pp. 47-60.