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A Mobility App for Everyone? an Empirical Analysis of User Types Based on Social Lifestyles and Personal Characteristics

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ABSTRACT

Who are the most frequent mobility app users and what are their main lifestyle and personal characteristics? This work aims to start a discussion and provide first insights into this question. Using a German-wide survey with a detailed collection of personal characteristics, lifestyle constructs, mobility preferences and patterns two cluster analyses are conducted to identify user groups. Based on the identified user groups the analysis of their app use follows to understand the usage behaviour of mobility apps. The results show that modernity and good amenities can promote mobility app usage, although mobility apps have a low usage rate, regardless of the identified user groups. Thus, the theoretical assumption that mobility apps are not yet widespread in Germany is validated, particularly in the older groups. It was identified that in terms of lifestyle "Modern Materialists" and "Relationship-oriented" users are more aware and use mobility apps more often when compared to "Conservative Loners". When it comes to personal characteristics "Privacy Protectors" are characterised by their higher concern for data protection and thus have lower usage rates when compared with "Combiners", the group of users which is comparatively younger, more educated and living in larger cities.

Keywords: Mobility app, User groups, Cluster analysis, Mobility survey, User behavior

INTRODUCTION

Travelling from A to B via an app? All relevant services (e.g., information, planning, ticketing) to reach the desired destination can be accessed through a smartphone. Whether you are travelling by public transport, carpooling, or renting an electric scooter - all you need to do is download the right app to ride or use and operate the selected means of transport.

Mobility apps offer what the name implies: apps that facilitate or enable mobility. Thus, many transport companies are striving to improve their apps and enrich them with more functions to advance the digitalisation of mobility (Redaktion Filstalexpress, 2022). In addition, projects are being developed for provider-independent apps that will enable digital-based mobility e.g.,

throughout Germany (dpa, 2022). Under this scope, we provide a sociological contribution to the investigation of mobility app usage and its potential in our daily life by focusing on the underlying user types and their app usage within the German market from the perspective of individual and societal impact factors.

Background and Scope

It can be stated that content and tasks can be used and approached on the move through apps. It thus enables media contact in situations in which media previously played no significant role. Therefore, the aspect of mediatisation is examined in greater depth in the context of mobility, where the focus is given to mobility behaviour and lifestyle.

"Mobility is a movement after an individual decision for a social offer that covers a need. Mobility therefore always stands for needs" (Becker, 2001). New mobility offers can serve them individually (Heggenberger and Mayer, 2018; Horn et al. 2018). This succeeds if they are recognized because especially in everyday traffic, people show habituated behaviour (Canzler, 2021; Gossen, 2012). People are thus rarely inclined to try out new and unfamiliar things and want to remain true to their lifestyle.

Among other things, lifestyle is based on a person's capital (Otte, 2004). "All the principles of division in the social world [...] function as capital in that the possession of socially recognised resources determines the availability of life opportunities [and thus also the living out of a lifestyle]" (Hillebrandt, 2022). According to Bourdieu's theory of practice, which is based on Marx's concept of capital, different types of capital are categorised: economic, cultural, social, and symbolic capital. One concludes that "The habitus determines what is possible - how an actor perceives the world, how he evaluates others, what his tastes are, how he thinks and acts, and how he presents his body and moves" (Meyen, 2007). The demands on mobility as well as mobility behaviour in general are therefore also socially and culturally determined, in that changed settlement and workplace structures, as well as values in our society, are also responsible for mobility behaviour patterns (Ackermann, 2020; Ince, 2021). The "Mobilities Paradigm" (Sheller and Urry, 2006) describes the importance of this by defining mobility as a component of social relationships, social participation, and everyday states (Manderscheid, 2021).

Therefore, the focus of this work is to conduct an empirical investigation from the user perspective, i.e., the consideration of person-based factors and lifestyle patterns influencing mobility app usage. In this context, we built our research question intending to enable a comprehensive consideration of the user perspective: Can different types of mobility app users be distinguished? We answer this question from the lifestyle and personal characteristics perspective with the help of a German-wide survey on the topic.

METHODS

A survey in a cross-sectional design is suitable for describing facts and circumstances (Koch et al. 2021). A systematic, sociological view of mobility app use through a survey can thus provide broad insights and support

the understanding of the most important component of mobility apps based on comparable user information.

The survey was designed to be both theory- and practice-based with four focal points, as explained below. After the introductory questions on the socio-demographics of the respondents, which play a descriptive role in the sample and data analysis, the topic section on habits followed. The questioning of this is based on the discussion of habitus found in the state-of-the-art literature (Ackermann, 2020; Ince, 2021) which states that habits are a relevant aspect of current and future behaviour. The consideration of mobility behaviour was also put into focus as an influencing factor of mobility app use (Le Bris, 2016) and finally, a section regarding app usage was included.

To analyse the collected data and classify the respondents, and consequently compare them along their mobility app use, a cluster analysis is chosen. This approach is used as well in-app research (Wangler and Jansky, 2021) and mobility research (Gossen, 2012) to describe user types. With the help of a cluster analysis, objects of study (in this case, people) can be grouped based on similar characteristics (Blasius and Georg, 1992). The objective of obtaining a group with homogeneous characteristics implies that different groups should differ as much as possible from each other (Scheufele and Engelmann, 2009). Since the respondents are assigned according to both individual and social characteristics, two cluster analyses were considered resulting in clustering user types according to personal characteristics and clustering user types according to their social lifestyle.

Quantitative investigation of mobility app use represents a new research topic; thus, a hierarchical cluster analysis is suitable for the exploratory approach. In this way, no predetermined number of clusters needs to be defined (Lengfeld, 2003) and can be identified on a case-by-case basis using the data obtained. The Ward procedure was used for the cluster allocation. In this process, each person is initially considered as a cluster and gradually combined until an acceptable cluster solution is found (Scheufele and Engelmann, 2009). This method offers the advantage that groups of approximately the same size can be formed, which are internally similar in terms of the characteristics considered (Scheufele and Engelmann, 2009).

RESULTS

A total of 6324 cases were collected, of which 3823 (approx. 60%) were incomplete or otherwise excluded. Therefore, the final sample consists of 2501 participants. The gender of the sample is balanced. Fifty per cent of the sample is male ($n = 1250$) or female ($n = 1247$) and three people identify as diverse. This roughly corresponds to the gender structure of the German population (Federal Statistical Office, 2022). The average age of the sample is 50 years ($M = 50.17$, $SD = 13.88$). The youngest respondent is 18 and the oldest is 80 years old. The age of the sample does not correspond to the German population (Knoema, 2020). Despite the quota, an underrepresentation of 20-year-olds can be seen (sample: 1%, German population: 19%; Federal Statistical Office, 2022). The 40- to 60-year-olds are overrepresented in the sample compared to the German population (sample: 44%,

German population: 28%; Federal Statistical Office, 2022b). Concerning the research goal of this work, it should also be mentioned that 91 per cent of the respondents own a smartphone as a precondition for app use, which represents the smartphone use of the population in Germany (Breunig et al. 2020).

The cluster analysis is done exploratively, as previously explained, there is no uniform statistical criterion for determining the number of clusters (Scheufele and Engelmann, 2009). After analysing the dendrogram and the assignment overview, both three and two-cluster solutions of the person-related characteristics were calculated and considered. Based on the results that could be interpreted in terms of content, the decision was made in favour of a two-cluster solution. The characteristics considered for clustering are based on previous research and available data. It was applied to derive basic attitudes, the use of technical devices and mobility behaviour as personal factors for the use of mobility apps. To compare the identified groups with each other, mean differences were considered, which are illustrated in Table 1.

Table 1. Personal characteristics used for clustering.

Clustering variables	Personal characteristics		*t*-test for independent samples
	Cluster 1 Privacy Protector ($n = 1575$) M (SD)	**Cluster 2** Combiners ($n = 627$) M (SD)	
General settings			
Privacy Concerns	3.59 (.96)	3.38 (.96)	$t(2200) = 4.64^{***}$
Environmental awareness	3.81 (.83)	4.08 (.72)	$t(1309.49) = -7.08^{***}$
Non-owner-occupied consumption	2.40 (.65)	3.05 (.83)	$t(939.39) = -17.53^{***}$
Technology affinity	2.89 (.89)	3.29 (.81)	$t(1251.97) = -9.92^{***}$
Smartphone /app usage			
Daily smartphone usage	3.38 (1.35)	5.48 (1.50)	$t(1051.05) = -30.43^{***}$
Use of online content via app	3.00 (1.06)	3.58 (.47)	$t(1619.34) = -14.52^{***}$
Number of installed apps	3.34 (1.28)	4.42 (1.15)	$t(1270.38) = -19.28^{***}$
App installation frequency	2.11 (.47)	2.68 (.79)	$t(807.20) = -16.82^{***}$
Number of app categories used	3.78 (1.92)	7.20 (2.48)	$t(937.85) = -31.03^{***}$
Frequency of app usage	6.89 (1.61)	7.79 (.55)	$t(2162.88) = -19.69^{***}$
Frequency of app usage outside the house	3.48 (1.57)	5.40 (1.21)	$t(1475.01) = -30.67^{***}$
Mobility behaviour			
"Multimodal"	1.31 (.37)	2.16 (1.50)	$t(656.62) = -14.06^{***}$
"Non-motorized"	4.88 (1.70)	5.89 (1.41)	$t(1374.10) = -14.30^{***}$
"Traditional car refuseniks"	2.94 (1.69)	4.84 (1.85)	$t(1063.90) = -22.29^{***}$
Combination of means of transport	2.97 (1.03)	4.02 (.84)	$t(1402.48) = -24.73^{***}$
Cluster-descriptive variables			
Age	52.98 (12.71)	40.44 (12.71)	$t(2200) = 20.91^{***}$
Highest level of education	1.78 (.88)	2.29 (.83)	$t(1200.40) = -12.78^{***}$
Place of residence	3.97 (1.97)	4.77 (1.95)	$t(2200) = -8.63^{***}$
Monthly net household income	4.93 (1.80)	5.47 (1.97)	$t(1060.37) = -5.98^{***}$

Statistically significant differences were examined using *t*-tests for independent samples. All respondents who use smartphones and apps served as the basis for clustering based on personal characteristics. This is the case since initial questions on smartphone and app use served as a filter and thus further questions on this topic were only displayed if people own a smartphone and at least occasionally use apps. In this way, the meaningful interpretation of the answers can be guaranteed without distortion.

In a second clustering, the respondents were grouped according to their social lifestyle. The characteristics that were considered for clustering are based on the society-oriented constructs reflected in the literature. The focus of this work is on lifestyle and social capital, which, based on theory, could influence mobility app use. For the calculation of the social lifestyle clusters, all participants were considered, except for the identified outliers, which distort the clustering. The cluster analysis resulted in three clusters of people, which were compared based on their average response tendencies using a single-factor analysis of variance (ANOVA). Like the *t*-test, the ANOVA is also bound to prerequisites that were checked before. Variables that are not normally distributed in the groups ("emotional support", "instrumental support", "positive capital", and "negative capital") were also considered for the analysis. The results of the analysis are shown in Table 2.

Table 2. Social lifestyle variables used for clustering.

Clustering variables	Cluster 1	Cluster 2	Cluster 3	One-factor analysis of variance (ANOVA)
	Modern Materialists ($n = 667$) *M* (*SD*)	Relationship Oriented ($n = 724$) *M* (*SD*)	Conservative Loners ($n = 1106$) *M* (*SD*)	
Lifestyles				
Modernity	3.19 (.43)	2.34 (.34)	1.90 (.50)	$F(2; 1562.44) = 1729.23^{***}$
Equipment	2.67 (.52)	2.47 (.37)	1.91 (.42)	$F(2; 1454.36) = 692.09^{***}$
Social Capital				
emotional support	.92 (.19)	.96 (.10)	.72 (.35)	$F(2; 1453.18) = 231.55^{***}$
Instrumental support	75 (.31)	.75 (.25)	.40 (.34)	$F(2; 1453.18) = 231.55^{***}$
Positive social capital	.75a (.31)	.75a (.25)	.40b (.34)	$F(2; 1453.18) = 231.55^{***}$
Negative social capital	.43a (.34)	.37b (.32)	.39b (.32)	$F(2; 2494) = 7{,}79^{***}$
Cluster-descriptive variables				
Age	43.37a (13.47)	50.58b (13.63)	54.00c (12.68)	$F(2; 1464.30) = 13.64^{***}$
Highest level of education	2.25a (.90)	2.01b (.88)	1.65c (.81)	$F(2; 1436.65) = 107.57^{***}$
Residence	4.70a (1.93)	4.15b(2.00)	3.98b (2.03)	$F(2; 2494) = 27.93^{***}$
Monthly net household income	5.76a (1.91)	5.40b (1.76)	4.30c (1.69)	$F(2; 1450.79) = 166.39^{***}$

DISCUSSION

The cluster analysis of personal characteristics shows that "Privacy Protectors" are characterised by their higher concern for data protection. They are less concerned with apps or their smartphone, which can also be described by their lower technology affinity. These characteristics are in line with the age of the group, as the typical app user tends to be the younger population (Yeeply, 2017). In general, "Privacy Protectors" are less likely to share. This applies to vehicles (variable "Multimodal") as well as other goods (variable "Ownership-free consumption"). This suggests that private ownership is important to them. Such fact can be traced back to the "Economy of Sharing" (Heinrichs and Grunenberg, 2012), which assumes that attitudes towards sharing goods influence the sharing of vehicles. In contrast "Combiners" are younger, more educated and live in larger cities. They are more likely to use public transport than the car, which could also be linked to their higher environmental awareness. Further, they are more open to using and combining different modes of transport and can thus be described as more participatory. Furthermore, they spend more time on their smartphone and with apps, also outside the home. What particularly stands out is that "Combiners" use many different app categories. The renunciation of one's car and the openness to different means of transport alternatives can thus depend on technical prerequisites and knowledge as well as on mobility behaviour (Canzler and Knie, 2018).

When it comes to app usage, in Table 3, it can be stated that mobility apps are rarely used, regardless of the mentioned groups. Thus, the theoretical assumptions that mobility apps are not yet widespread in Germany can also be agreed with from an empirical point of view. This applies both to the number of mobility app categories and the overarching view ("use of mobility apps" variable).

What can be determined from the differences in statistical significance in the answers of different clusters, however, is that personal characteristics influence mobility app use. Looking back at the characteristics of the "Combiners", younger people living in cities with a higher level of education and income are more likely to know and use mobility apps. In addition, further comparison of the two clusters shows that people who have an affinity for technical devices and use different apps, such as "Combiners", tend to use mobility apps more than the "Privacy Protectors", which are characterised by their data protection concerns.

From the lifestyle perspective, the results show that people who like to maintain a high standard of living and have a modern lifestyle, are described as "Modern Materialists". This group is characterised by the fact that it spends the most money in comparison to the other groups. In addition, they have the financial resources to own vehicles and are the most cultured (indicators of the variable "furnishings"). "Modern Materialists" are also more likely to maintain social relationships that can have a detrimental effect on their person ("negative social capital" variable). This may be explained by the fact that they live in the largest community and can meet more different people. "Relationship-Oriented" can be described above all by

Table 3. Comparison of mobility app usage between personal characteristics clusters.

	Personal characteristics		*t*-test for independent samples
	Cluster 1 Privacy Protector *M* (*SD*)	Cluster 2 Combiners *M* (*SD*)	
General Mobility App Usage			
Use of mobility apps	1.75 (.57)	2.67 (.94)	$t(816.08) = -22.67^{***}$
Frequency of mobility app use	1.90 (.99)	2.92 (1.09)	$t(1120.99) = -17.14^{***}$
Number of mobility app categories used (inactive)	.42 (.86)	1.23 (1.73)	$t(751.44) = -11.14^{***}$
Number of mobility app categories used (active)	.39 (.79)	1.82 (1.91)	$t(712.75) = -18.15^{***}$
Use of specific mobility app categories			
Long-distance apps	2.61 (1.39)	3.40 (1.29)	$t(1234.74) = -22.33^{***}$
Public transport apps	2.55 (1.42)	3.97 (1.34)	$t(1216.49) = -22.21^{***}$
Car sharing apps	1.64 (.71)	2.41 (1.24)	$t(795.18) = -14.62^{***}$
Ride-hailing apps	1.41 (.66)	2.22 (1.32)	$t(754.52) = -14.73^{***}$
Taxi Apps	1.77 (.85)	2.60 (1.38)	$t(882.07) = -13.97^{***}$
(E-) Bike sharing apps	1.54 (.69)	2.30 (1.24)	$t(783.86) = -14.29^{***}$
(E-) Scooter sharing apps	1.54 (.75)	2.40 (1.35)	$t(787.64) = -15.14^{***}$
On-demand shuttle apps	1.40 (.64)	2.08 (1.27)	$t(754.80) = -12.70^{***}$
Intermodal apps	1.32 (.64)	2.05 (1.35)	$t(738.18) = -12.88^{***}$

the strong emotional and instructional support they receive from their environment. They are older and less educated than the "Modern Materialists", live in smaller towns and have a lower income. The cluster group attach great importance to social relationships and expanding their network. This is different with the "Conservative Loners", who make up the oldest and largest of the three clusters. They tend to live a traditional lifestyle. Accordingly, their leisure time may well be more quietly arranged ("modernity" variable). The furnishings, i.e., the maintenance of a high standard of living or the ownership of vehicles, are also the least important to them. The "Conservative Loners" have both a few positive and negative social relationships. This could be related to the fact that this cluster group tend to live more secluded lives (e.g., in smaller towns) and seek fewer social relationships.

In the personal characteristics cluster analysis, it can also be stated here that the use of the mobility app and the respective categories is similarly low to the person-related characteristics clusters, see Table 4. Just as with the "Privacy Protectors" and "Combiners", classic transport apps are also the most popular regardless of the social groupings. This is in line with earlier studies that demonstrated the popularity of public transport apps in Germany (Viergutz, 2017).

"Modern Materialists" know and use the most app categories in comparison and have also had the most experience with them in the past ("Inactive mobility app use" variable). In terms of the individual categories, they also know the most apps and tend to download them more often. This could be explained by their busy and modern lifestyle which makes them notice new mobility offers faster. Likewise, their place of residence, in a more urban area,

Table 4. Comparison of mobility app usage between social lifestyle variables.

	Personal property clusters			One-factor analysis of variance (ANOVA)
	Cluster 1 Privacy Protector *M* (*SD*)	**Cluster 2 Relationship oriented *M* (*SD*)**	**Cluster 3 Conservative loners *M* (*SD*)**	
General Mobility App Usage				
Use of mobility apps	2.58 (1.02)	1.95 (.63)	1.68 (.53)	*F*(2; 1208.67) = *211.07****
Frequency of mobility app use	2.83 (1.16)	2.11 (1.07)	2.01b (1.00)	*F*(2; 821.38) = 70.61*****
Number of mobility app categories used (inactive)	1.23 (1.78)	.53 (.94)	.34 (.74)	*F*(2; 1162.61) = *71.56****
Number of mobility app categories used (active)	1.56 (1.97)	.67b (1.06)	.39 (.74)	*F*(2; 1119.40) = 105.34*****
Use of specific mobility app categories				
Long-distance apps	3.64 (1.41)	3.07 (1.47)	2.53 (1.40)	*F(2; 1368.09) = 113.00****
Public transport apps	3.53 (1.47)	3.02 (1.52)	2.52 (1.46)	*F(2; 1368.21) = 87.40****
Car sharing apps	2.39 (1.26)	1.79 (.79)	1.55 (.65)	*F(2; 1205.82) = 120.41****
Ride-hailing apps	2.18 (1.32)	1.53 (.76)	1.36 (.63)	*F(2; 1190.91) = 104.63****
Taxi Apps	2.59 (1.34)	1.92 (.95)	1.68 (.81)	*F(2; 1241.41) = 114.50****
(E-) Bike sharing apps	2.31 (1.28)	1.65 (.72)	1.46 (.61)	*F(2; 1194.91) = 123.13****
(E-) Scooter sharing apps	2.36 (1.34)	1.69 (.85)	1.47 (.72)	*F(2; 1214.92) = 114.38****
On-demand shuttle apps	2.11 (1.27)	1.50 (.70)	1.32 (.57)	*F(2; 1179.46) = 106.72****
Intermodal apps	2.08 (1.34)	1.40 (.74)	1.25 (.55)	*F(2; 1147.48) = 110.01****

could contribute to the fact that more transport options that have an app are available in their vicinity. "Relationship-Oriented" people are more familiar with mobility apps than "Conservative Loners". This may be because they are surrounded by more people and are therefore more likely to be aware of the topic of mobility apps. Thus, the urge to belong could also play a role when it comes to engaging with mobility apps. "Relationship-Oriented" people are also more inclined to use mobility apps because their social environment does. In contrast to the "Conservative Individuals", "Relationship-Oriented" have at least downloaded public transport and long-distance transport apps and are more familiar with the remaining categories than the third cluster. If we compare the cluster-forming variables, modernity and equipment are also important to this group, which could be another reason for being busy with mobility apps, as mentioned in the case of the "Modern Materialists".

"Conservative Loners", who make up the largest social cluster of the sample, are the least familiar with mobility apps. On average, they hardly used

and still use any mobility app category. Especially new app-based mobility types, such as intermodal or on-demand shuttle apps, are the least known in the group. It is possible that they have not engaged with this mode of transport yet, as they are rather reluctant to share journeys with others due to their social characteristics. This is aligned with the traditional view of mobility where the car is a central component of a person's individual-oriented way of life (Burkart, 1994; Canzler and Knie, 2016). "Conservative Loners" might therefore be more averse to mobility apps that primarily offer alternative mobility solutions, as they prefer the traditional lifestyle. In addition, they are on average the oldest, which is why they are more likely to perceive and use classic means of transport such as public transport and taxis which are already widely established.

CONCLUSION

In summary, modernity and the importance of good amenities can promote mobility app use. Likewise, strengthened social relationships and openness to a variety of social contacts seem to influence the knowledge and use of mobility apps. This is shown by the higher awareness and use of mobility apps among "Modern Materialists" and "Relationship-Oriented" compared to "Conservative Loners". People who do not attach great importance to social contacts or a modern, upmarket standard of living are therefore hardly aware of and use mobility apps.

According to the discussion, the usage of mobility apps tends to be influenced by several attributes and thus must be designed as target group-oriented. However, it is important to highlight an influencing limitation of this work. Unfortunately, it was not possible to ensure a representative sample of the young population (particularly in the <20 years segment). This segment shows a higher interest in technical innovations and thus might use mobility apps differently.

Nevertheless, the potential of mediatised mobility can be recognised in individual means of transport, especially through the identified familiarity. Mobility apps could therefore become increasingly important for our society in the future. The question, therefore, remains: Will mobility apps become a solution for everyone in the future?

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