Ministry of Infrastructure
and Water Management

Online influencing of travel behaviour

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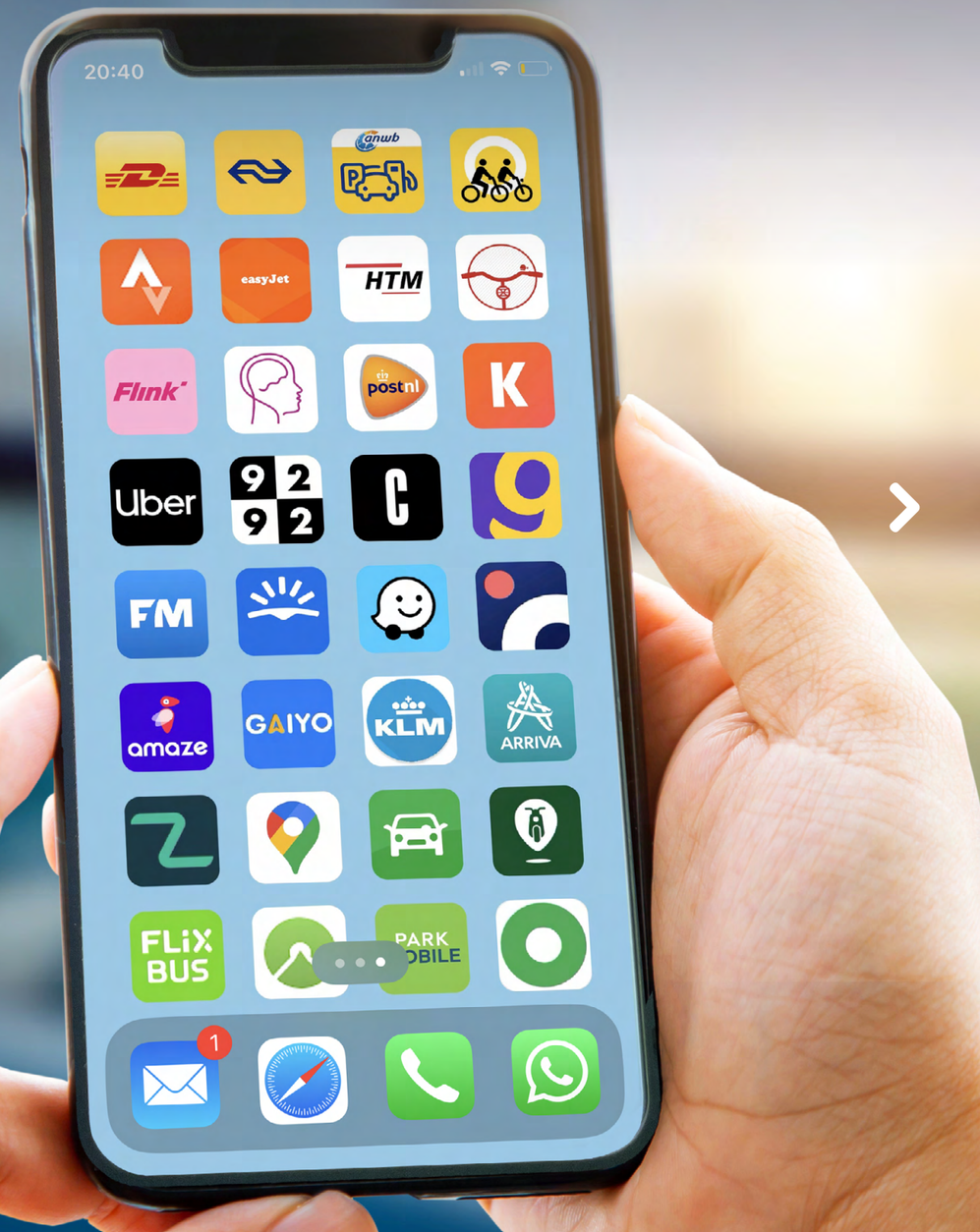

KiM | Netherlands Institute for Transport Policy Analysis

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Summary and contents

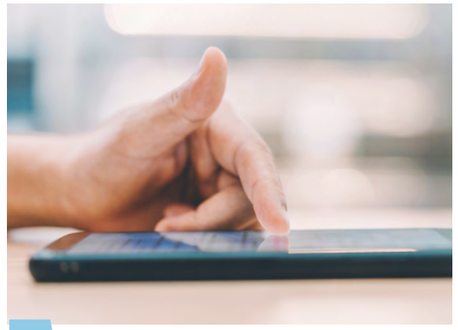
Apps influence people's travel behaviour in three ways: [1] ease of use, [2] persuasion and [3] dysfunctionality. The Netherlands Institute for Transport Policy Analysis (KiM) investigated these influencing processes, with a focus on persuasion, by way of a literature study and an analysis of 32 mobility apps.

The primary way in which mobility apps influence our behaviour is instrumental. The information offered by the app can make travelling faster, cheaper or more fun. This in turn reduces the users' travel impendency, which can result in more or longer journeys.

Within the investigated apps, the persuasive techniques vary widely in terms of intensity and diversity. The techniques are linked to raising awareness, providing incentives or altering the choice architecture of the app. The latter refers to the way in which the choices are presented to the user.

Persuasion is hardly new. New in the digital online world are the scale, the dynamism and the customised way in which the persuasion can be delivered. It is now possible to observe better than ever before to what extent the interventions prove effective, through constant monitoring and experimentation. It is also possible to send the information in a far more targeted manner. Persuasion becomes more effective if a specific incentive is presented to the right person at the right moment.

It is not possible to discover everything purely on the basis of observations in apps. It is also no easy task to expose the intentions of the developer. Moreover, all of our findings are snapshots in time.



1 Influencing via apps

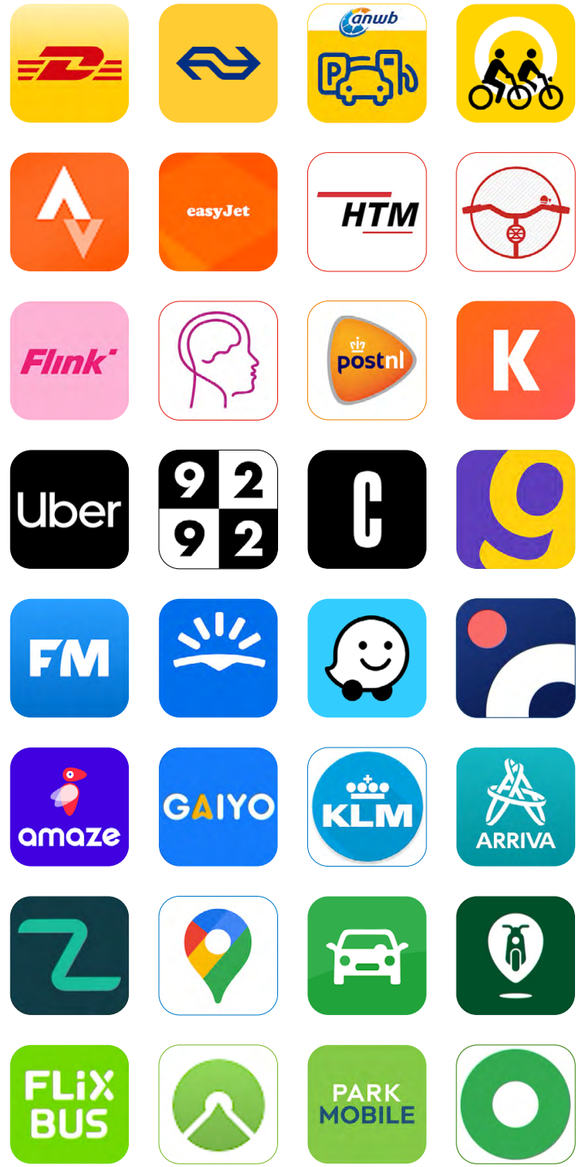
In this brochure, we consider the ways people's travel behaviour can be influenced via apps. The primary focus of our study is persuasion. We conducted this research on the basis of a literature study and an analysis of 32 mobility apps. The primary aim of this study is to make policymakers and users of the apps more aware of the way they are influenced.

The irresistible rise of the app

Mobility apps are extremely popular. Whether for finding the shortest route by car, the nearest supermarket, bus departure times, a fun bicycle tour or a cheap air ticket, today much of what we do is made possible via an app.

For many businesses, institutions and government organisations, an app is the preferred means of communicating with their target group. Transport companies follow the 'mobile first' principle, where the app is considered the first and primary point of access to information.

The success of the mobility app goes hand in hand with the undeniable success of the smartphone. When we undertake a journey away from home we not always have access to travel guides, housemates, manuals or a desktop computer, so the presence of a miniature, easily hand-held computer is the perfect solution for many. Almost every adult in the Netherlands today has access to a smartphone with a 4G data bundle.



A neutral tool?

Many view the app as a neutral tool. This ties in with the broadly shared vision on our relation to technology. The app does what the user wants as long as they know how to use it. However, this picture of neutrality is at odds with practice.

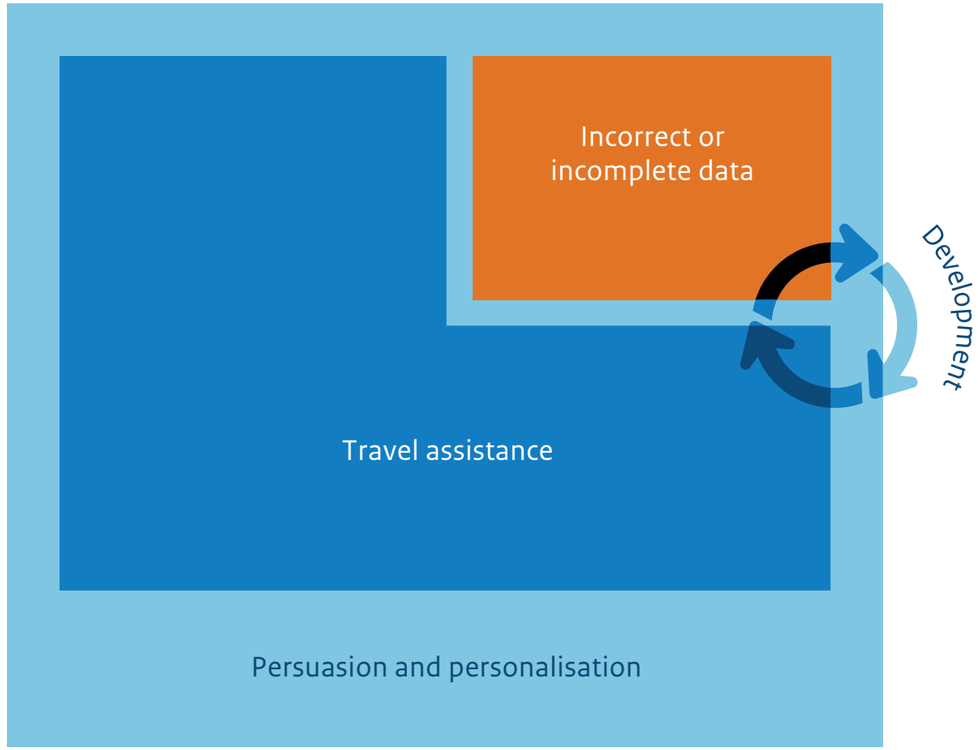
After all, via our smartphone and the apps installed on it, our vision of the world is changed, and our priorities and needs are shifted. There are in fact indications that our brain physically adapts once we switch from self-navigation to using a navigation app. Likewise, our travel behaviour changes.

The apps on our smartphone mean we do different things than we did in the past. This is partly the consequence of experiencing less resistance to travel; after all, the app makes it easier for us to travel, we are less likely to become lost and we are more quickly able to find routes for our journey, or better connections on public transport. Consequently, if we save time or money, we may be encouraged to travel further or more.

Functional and dysfunctional

The app and the information it provides us with makes travel just that little bit faster, easier, cheaper or more fun. The traveller uses these benefits to travel more often or a little bit further, to take a different route, or to reach home earlier. This functional or instrumental aspect is the dominant form of influencing by apps. This functional added value of mobility apps is the central aspect of another study by the KiM.[1]

Forms of influencing via mobility apps



The trust people have in digital tools can also turn against the user, for example when they abandon their own ability to think in favour of 'smart' apps. Misleading communication, incomplete information or poor algorithms can lead to people making suboptimal or even wrong choices.

1 *Durand, A. Hamersma, M. and Rienstra, S. (2023) Digital travel information – An analysis of its use and perceived effects for travel by car and public transport. The Hague: Netherlands Institute for Transport Policy Analysis.*

This above all happens when they fail to recognise the ‘dysfunctionality’ in the app, while they in fact expected to be able to count on the accuracy and completeness of the information offered. This ‘automation bias’ can lead to unwanted outcomes in two ways: [1] the traveller follows the incorrect or incomplete information almost slavishly, or [2] the traveller does not receive the information they expect at a particular moment.

A typical example of dysfunctional automation is ‘death by GPS’. There are many stories of people who have ended up in precarious situations as a result of following automated travel assistance.

Persuasion

Techniques sending the users in a particular direction are applied in tandem with functional elements of the apps. Mobility apps attempt to influence travel behaviour, for example with a view to better managing capacity for the benefit of the transport operator, to draw attention to new services or to increase turnover. The intentions and motives are generally unknown but can often easily be guessed namely: safeguarding the business model.

Certain ‘persuasive apps’ have the explicit objective of changing travel behaviour and offering the user assistance by for example encouraging them to walk more or cycle more often. This assistance consists of a whole palette of influencing techniques. These (and other) techniques are however also present in other apps.

There are innumerable effective principles for redirecting users’ behaviour. It is often a relatively simple matter to recognise these principles once you become aware of them. Nevertheless, certain principles are hard to observe for an individual. Successful application in the app is no guarantee. In the next section, we discuss the various forms of persuasion employed.

2 Forms of persuasion

Apps are able to influence our behaviour via persuasion. Persuasion techniques are generally found in and around the functional core of the app. Techniques are, for instance, use of social pressure, economic incentives or game elements. In this section we provide an overview of the techniques employed.

Advertising

There is no question that advertising can make a contribution to a company's commercial objectives. There is sufficient scientific evidence to back up this claim. Commercials kindle our desire for a product, change our wishes, standards or priorities and make us more materialistic. Like all other techniques, commercials are not necessarily always successful.

Advertising serves a variety of functions. Commercials increase the awareness of a product or encourage people to buy it. A company like Facebook earns billions of dollars with the advertising messages that invite people to install other apps. A number of the apps included in our study also advertise on social media. Once the app has been installed, we are subsequently regularly confronted with push messages offering special offers, promotions and suggestions. A purchase decision can for example be forced by a pop-up or an email reminding us of our shopping basket left alone.

Inspiration

Many of the mobility apps have an exploratory character, or include explorative elements. The app offers suggestions for certain destinations, including professional photographs of iconic buildings, stunning views or world-famous tourist attractions. Once an account is created within the app, we automatically receive new travel opportunities, suggestions for destinations and free trial periods or journeys, in our mailbox.

A variety of multimodal apps scan the immediate vicinity. They then produce an overview of the travel modes and opportunities possible from the current location. However, these apps offer no comparison in relation to other aspects that passengers may consider important such as journey time, travel costs or environmental impact. It is also not immediately clear whether the suggested mode is in fact at all suitable for the intended journey. In certain cases, the app does not even include a travel planner.

This raises the question to what extent the app in fact meets the needs of the user. Does it offer new possibilities for travellers to satisfy their travel needs? Or does it kindle new desires?

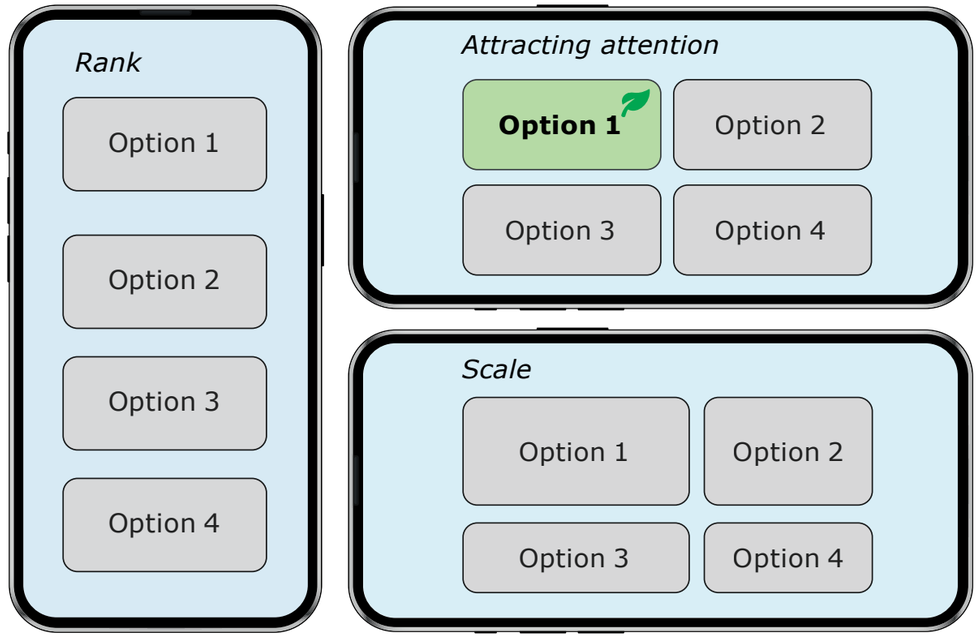
Choice architecture

Any choice presented to an app user unavoidably takes a particular form. The order in which the options are presented, the way in which they are discussed, the size of the buttons within the app or the sequence of choices are all examples of the choice architecture.

Each design results in shifts in the choice behaviour. The form in which the choice is presented to the user in fact creates space for exercising influence. One well-known example is the donor card. In the Netherlands, we have switched from the standard of not being a donor with the possibility to opt in, to the standard where we are a donor, with the possibility to opt out. As a result of this change, the number of donors has risen considerably.

This so-called default effect is also reflected in apps, for example in the form of a standard journey time of seven days, or an automatic subscription to the newsletter (for commercials). Once we have registered, subscribed or joined the club, we only rarely take the initiative to actively change the situation.

Examples of influencing via design



Moreover, people show the tendency to select the first option presented, in a list. This is known as the primacy effect. This effect is clearly manifested in search engine results. Most people do not go beyond page 1, and on that first page they often also select the first option available. This is also where we find the sponsored links. In mobility apps, the results mostly appear in a logical order, for example sorted according to departure time, journey time or price.

Economic stimuli

The idea of scarcity motivates people to take action. Scarcity can take the form of limited capacity (‘only 4 seats available’) or limited time availability (‘this deal expires today’). Both of these stimuli are shown to be effective and are regularly used in mobility apps.

← *Limited time availability*

← *Limited capacity*

← *Free extras*

← *Reward*

← *Absolute discount*

← *Relative discount*

← *Hot*

← *Popular*

Discounts help tempt consumers. Merely the idea of a discount is often sufficient; there need not be actual price reductions. The idea is generated by introducing a discount percentage or absolute point of reference showing the 'old' price.

'Free' is a magic word that can also be included under the heading economic stimuli. People respond strongly to the word 'free'. In practice, the word free is often used for a free introduction to the paid version of the app, new travel opportunities or specific functions. It is also common practice to offer 'free' transaction costs, free booking or other free elements.

Rewarding the target behaviour is another economic stimulus. Examples include the opportunity to save points for daytrips or handing out vouchers or discount codes for the next visit. In the analysis of mobility apps, this specific stimulus is of lesser importance.

Self-monitoring

One of the forms in which persuasion is manifest is self-monitoring. Within the app or via a monthly update in their mailbox, users receives an update of the number of steps they have taken, the distance they have travelled by bicycle or the number of speed cameras they have succeeded in avoiding.

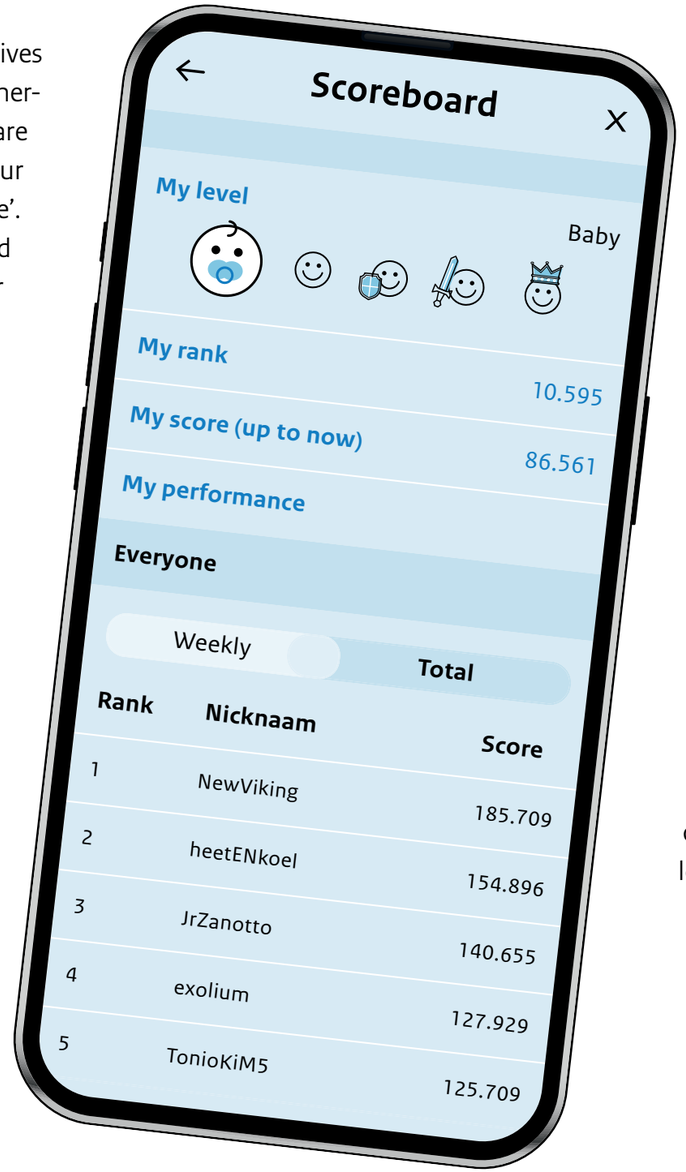
This form of persuasion can result in increased awareness or a confirmation of the user's own performance. The app assists the user by comparing performance scores, averages or other reference points with the levels achieved in the past. In the superlative form, people can set targets that are preferably recorded and shared with others. The app is then responsible for recording the results achieved on behalf of the user.

An app that monitors performance also gives the users practical suggestions. These generally take the form of calls to action: 'You are moving less than normal – check out your statistics – take a walk or go for a cycle ride'. This encouragement to take action is linked to the prevailing social standards. Take for example today's adoration of a healthy body and the discontent of people with obesity.

Social incentives

Converting and adding performance scores in various different areas can also represent a form of influencing. The abstract points become a goal in themselves. These points may be virtual, without any real meaning in the physical world, but they can also serve as an alternative currency, thereby becoming an economic stimulus.

The number of collected points is regularly compared with the total scores achieved by others, thereby creating a competition status. One concrete example in the Netherlands is the Ommetje app, which encourages the participants to make walking a 'fun, daily habit'.



By scoring points, you can acquire a certain status. Participants with a low score are referred to as starters, amateurs or sleepers, while participants with a high score are awarded the title king, emperor or admiral. Waze, which offers traffic information to car drivers, is an example of an app employing a hierarchy of this kind.

Game elements

Innumerable apps offer the possibility of completing tasks or achieving targets. Adding game elements to apps that are not essentially games is known as gamification. During the course of our study, the Dutch Car Owners Club ANWB for example organised a game as part of its anniversary celebrations, whereby participants were encouraged to seek objects on the map, on the basis of clues. If the actions within the game are in line with the provider's aims, the game can be seen as a form of persuasion. The game can for example focus attention on new functionalities offered by the app.

It is unlikely that people will describe Pokémon Go – one of the most popular apps ever – as a form of gamification, as no game elements have been added. It simply is a game. However, a great deal depends on the unknown aims of the developers: is it about the game or is the aim in fact always to direct people towards certain sponsored locations?

Community feeling

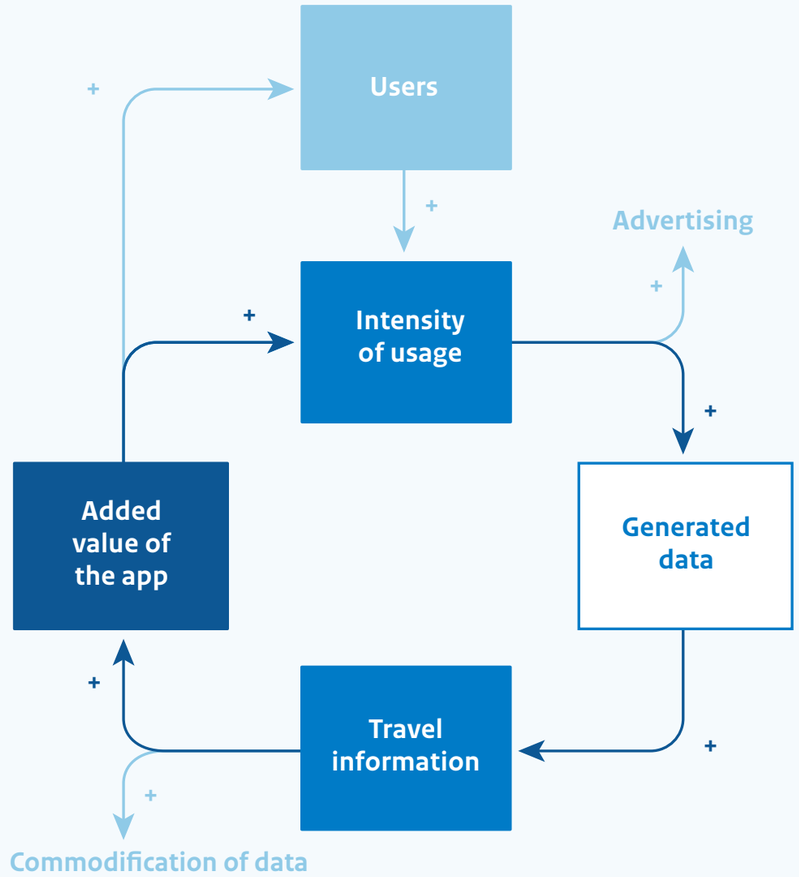
One essential characteristic of today's online world is that the app users themselves voluntarily generate much of the content, completely without obligation. In many cases, they in fact transfer the ownership of this content to the platform via which they share photographs, videos or personal details.

Based on this rich influx of data, new and existing users are fed with information and entertainment. A number of apps in the world of mobility also contain similar user-generated content. Waze and Google Maps are well-known examples, with large numbers of users. These apps aim for a sense of community, the importance of sharing and handing out points to participants who supply the greatest volume of information for other users. Maintaining the cycle of data gathering and data sharing relies on this community.

The quality of the service offered by the app is directly and to a large extent dependent on the willingness of the users to share information. The information they share in turn influences the behaviour of the users for example in avoiding speed traps and traffic jams.

The persuasion is aimed at sharing information as a means of safeguarding the functional aspects of the app. As the figure opposite shows, encouraging this cycle serves the business model on which the app is based.

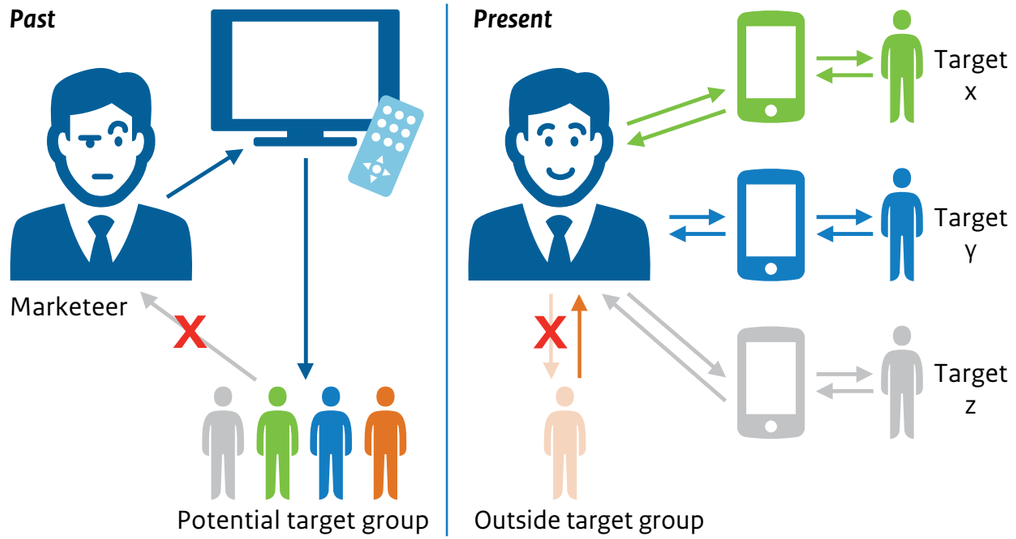
Self-reinforcing effect via user generated content in relation to the business model



3 Monitoring and customisation

Most forms of persuasion are hardly new. The new element is the scale and intensity, and the customised manner in which they are offered. Ideas about diversity, target groups and targeted communication can now be put into practice at high speed and with a high degree of precision. Moreover, it is also possible today to monitor the effect of individual interventions in detail, thanks to the numerous sensors in the devices and the generated data traffic.

Development towards micro targeting



Personalisation

In the burgeoning online world, personalisation – the customisation of products and services – offers a welcome solution to users for separating the wood from the trees. By matching search results or options with the present, the current location of the person initiating the search and their personal preferences, a great deal of unnecessary baggage can be avoided.

We express our personal preferences by individually changing particular settings, activating particular areas of interest or specifying particular priorities. At the same time, a whole raft of automated filters and rules based on past behaviour are often also invisibly active in the background.

By personalising the communication, the likelihood of the user of the app receiving the message clearly is often considerably increased. By including a personal address, the probability is further increased of the receiver opening the message. And with a personalised news offering – with the items ordered on the basis of the user's interests or with 'irrelevant' items left out – the likelihood of someone viewing the item can be significantly boosted. This development is often accompanied by warnings of the creation of a bubble: people are given what they get because they keep on doing things they have done in the past. Personal profiles also enable companies to increasingly focus commercial messages on a particular target group. In the right conditions, a better match to an individual's potential needs can increase the provider's success rate. However, app users should not be given the feeling that they are being spied on, or that choices are being made on their behalf.

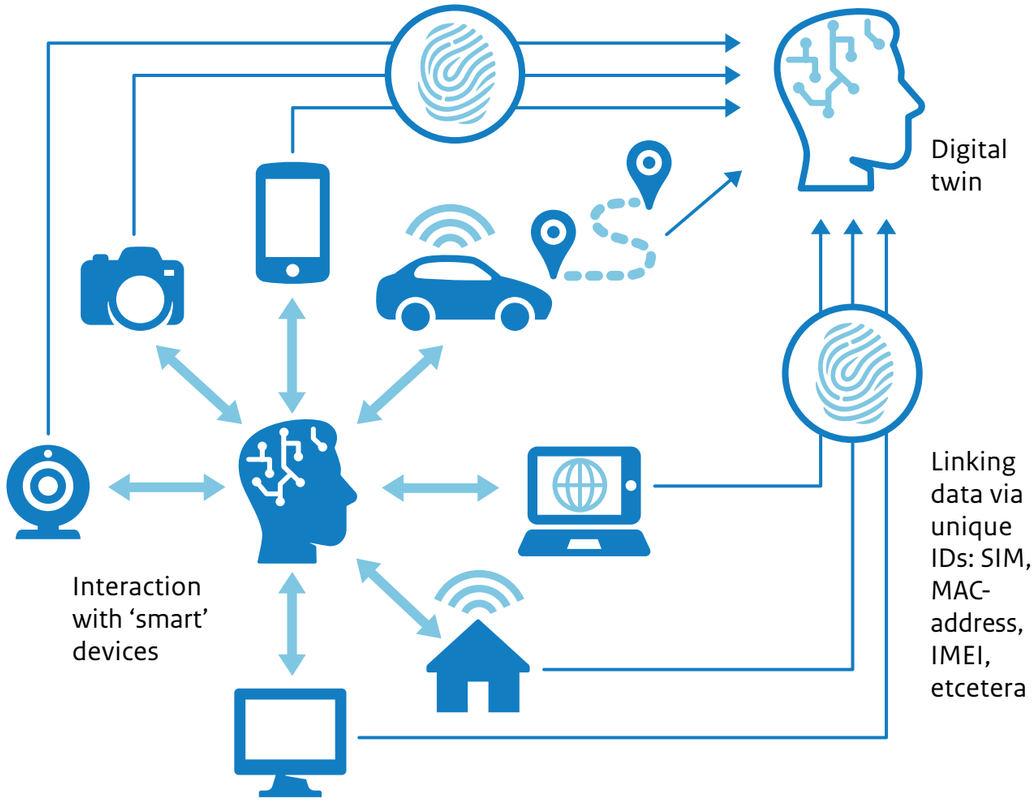
Personal information is also used for price discrimination and offer differentiation. Price discrimination means offering different prices for the same service, depending on a person's profile. Based on the expected willingness to pay, the price is either raised or lowered. Uber for example uses this kind of price discrimination. Offer differentiation describes the process according to which a person's profile determines which products or services they are offered.

Next level: the influencing profile

By exposing a single person to a variety of different stimuli in different situations, it is possible to create a person-specific influencing profile. Using this profile, it is then possible to predict which stimuli will be most effective for the individual person in question. After all, susceptibility to stimuli varies widely between individuals: one person may be susceptible to other people's behaviour and to peer pressure, a second person may specifically want to be unique, while a third person is a bargain seeker who above all responds to price stimuli.

Thanks to experimentation, data gathering, tracking and the construction of a digital twin, it is now technically possible to generate an influencing profile of this kind. Thanks to unique digital fingerprints and interaction with smart devices, an individual profile is created for the digital twin, as shown in the figure opposite. In the world of e-commerce there are in fact concrete examples in which influencing profiles are created, and whereby the effectiveness of the stimuli has been demonstrably improved. Whether and to what extent the apps analysed in this study employ this kind of profiling is difficult to determine. We do however have a clear picture of the permissions the app demands of a user, and the data traffic that takes place behind the app ('tracking').

The digital personal profile



Tracking

The smartphone is an advanced measuring device with a number of accurate sensors, including sensors for light, sound, vibrations and movements. Apps gain access to these sensors via permissions and pass on the gathered data to interested parties. By experimenting with different versions and forms of the offered information, it is possible to detect differences in behaviour. In this way, a greater pool of knowledge about the power of influence is rapidly gathered.

Via tracking, interaction with the smartphone can be remotely monitored, in real time. This information can be further enriched with data from other devices, via shared accounts and unique digital fingerprints.

In the 32 mobility apps investigated by us, via a static analysis, we detected numerous tracking addresses. On average, an app transmits data to seven addresses. Google and Facebook stand head and shoulders above the rest. The only app with no link to Google was the Fietsersbond app; the remaining apps were all Google linked. The list of transmission addresses also includes other well-known players in the field of online profiling and interventions.

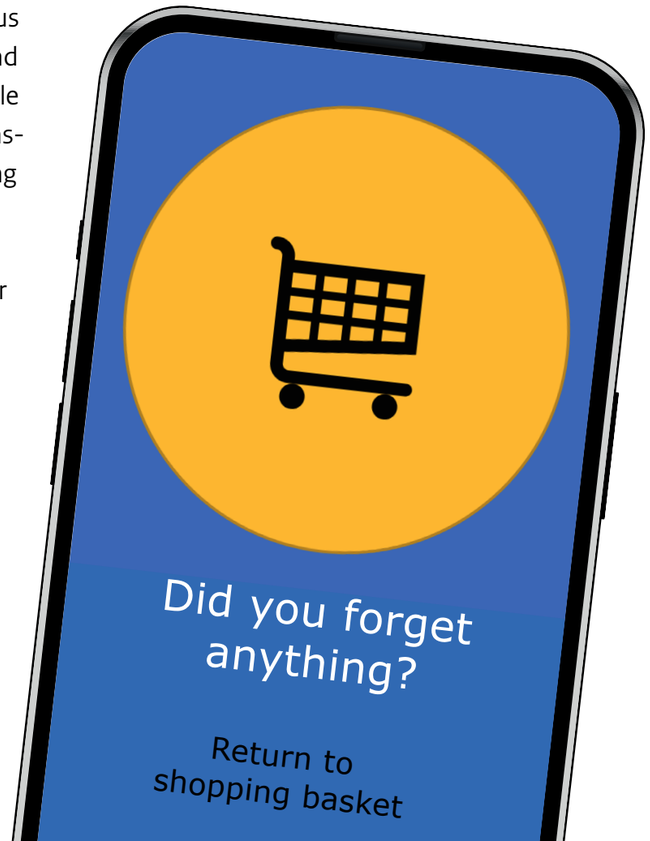
Not all tracking activities are specifically aimed at tempting the user. Tracking can, for example, also be used for monitoring use intensity and possible disruptions.

Permissions

All apps demand specific permissions from the user. In our analysis, the number of permissions requested ranged from seven to 39 unique permissions for each app. By installing the app, the user agrees to the majority of these permissions. Further approval is requested explicitly for a number of permissions, depending on the operating system and the personal settings. It is now much clearer to users which permissions are being requested. In the past, they were faced with a high ‘silence implies consent’ rate.

Many of the permissions requested or required by the app are intended to increase practical ease of use. Typical examples are starting up the app automatically when the user activates the smartphone, ensuring that it automatically operates in the background or preventing the smartphone switching to standby mode. The smooth use of the app also increases the effectiveness of influencing. If disruptions occur, for example, people tend to lose their concentration.

However, it is certainly not easy to link all permissions to the functionalities of the app, or its use. A number clearly serve the data hunger of those parties whose aim is to tempt the users. Others are intended for generating data for sale to other parties. Via the permissions ‘view telephone status’ or ‘view accounts on device’, personal data can be linked together between an individual user’s apps or devices. These types of permissions occur nine and six times respectively, in the 32 apps we investigated.



Permissions can also fulfil a dual role; both for the functional aspects of the app and for surveillance. The precise location of the user is a typical example. Recent studies suggest that two out of every three data transfers that are shielded by permissions cannot be directly linked to the functionality of the app. This creates risks in terms of security and privacy. Data transfers can in fact also disrupt the functionality, by for example slowing down the app.

4 Implications for policy

Exerting influence on travel behaviour

As a rule, a mobility app supports the user, but to actually make a journey, knowledge, skills, a vehicle, space and infrastructure are also needed. In this sense, merely using a mobility app is unlikely to bring about any revolutionary change. Also because the app is not only dependent on the influence it exercises and the effectiveness of that influence, but also on the use of the app. Even the most powerful influencing machines have no impact without users.

The chain that links persuasion in the app and actual travel behaviour is a long one. Not all attempts at tempting the user are effective. Even if someone is more likely to click on a link, this does not necessarily mean that they will change their destination, departure time or mode of transport. Let alone that it will bring about structural change: changes that will remain in place without the app or the intervention. In order to make the transition from behaviour change in the app to changes in travel behaviour, a number of steps have to be completed. And each step has its own set of vulnerabilities.

Nonetheless, evidence from other studies and sources does suggest that many techniques for persuasion do bring about a change in travel behaviour. These studies look beyond the app and actually monitor people's travel behaviour.

There are also more complex constructions whereby although the persuasion cannot be linked directly to travel behaviour, the incentive serves other forms of influencing. In particular creating an account, sharing personal data or sharing travel details are clear examples. In the future, the account can then be used for such things as advertising messages. Or the travel details can be used to give other travellers an insight into the traffic situation, which may lead them to make other choices.

The need for subtlety

Persuasion often ties in with the instinctive, non-rationalised behaviour that guides the majority of our actions. Specifically because people instinctively operate on autopilot, the attempts at influencing are effective. When people realise that something unusual is happening, the autopilot function is disabled, and their actions become more conscious.

The demand for subtlety suggests that there are limits to the possibilities of influencing people via apps. It is not simply a question of stacking principle on principle in order to achieve the maximum result, especially if as a consequence the functional aspects of the app could be placed at risk. This makes it difficult to say which apps from our study exercise the greatest influence on behaviour, without having a complete picture of the behaviour of the users and possibly even a control group. In addition, in our study, we were unable to directly observe all influencing principles, which left us with an incomplete overall picture.

In every single instance, the central focus must remain on the primary function of the app. After all, an app that offers no added value to the passenger, and which is packed exclusively with influencing techniques, will have little impact.

Personal responsibility

Many of the apps radiate good intentions. Be it saving money, driving safely, exercising healthily, cycling more or losing weight, there is a wealth of apps on offer that aim to help people achieve their goals. The constant data flows, sensors and game elements all open up new opportunities.

This development is supported by various government bodies and organisations. In the current debate, it is no easy task to be actually critical of this development. How can you possibly oppose an app that helps people achieve a healthy weight, or encourages them to cycle more often?

One important step in expressing criticism is recognising the limited scope of the app. Such issues as obesity or car use are acquiring epidemic proportions in many countries, while the focus of the app is on personal choices and personal responsibility. These two aspects are difficult to reconcile since the scale of the problem in fact suggests greater – more structural – underlying factors. Take, for example, the innumerable advertising messages for unhealthy foods, the unsafe nature or sometimes complete absence of an infrastructure for active traffic participants, the limited availability of healthy foods, unhelpful tax rates, and insufficient or biased information provision. All these issues cannot be tackled individually by people (via the app), but in fact require a far more vigorous intervention. The overwhelming praise for apps, with the related investments, may well be to the detriment of more fundamental possible solutions.

Need to act?

On the basis of our study, conducted on behalf of the Ministry of Infrastructure and Water Management, we cannot conclude that online influencing results in a large-scale mobility problem that needs to be tackled. Although we have no representative picture of the use of the apps or the consequences of that use, we are able to conclude that despite the use of influencing principles, the overriding intention of the various mobility apps is their functionality. Furthermore, the market structure and regulation mean that certain forms of persuasion remain almost irrelevant. For example, if price agreements are in place, attracting people's attention with real discounts becomes irrelevant. At the same time there are a number of apps that use unusual or undesirable incentives that seem contradictory to the interests of accessibility, safety and sustainability. Other public interests may also be at risk, including privacy and autonomy.

Certain policymakers may find themselves sorely tempted to employ the same influencing principles in the public interest. Possibly with the support of market parties, this could lead government to launch apps aimed at encouraging people to walk or cycle more, to save energy, to address fuel shortages or to tackle the climate crisis. The questions that emerge are whether the behaviour changes in fact tie in with any particular need, whether they are appropriate to the role of government and whether they in fact give rise to certain ethical objections. After all, if government itself employs the techniques of persuasion, how can other parties be called to account for the same behaviour? Apps of this kind infringe on a person's personal autonomy. Openness and transparency about the intentions of the app are therefore essential, but can at the same time undermine their effectiveness.

Various commentators and opinion makers in the field of digital persuasion are critical about the actual effectiveness of online influencing. The debate about online persuasion is framed as a storm in a teacup: since the level of effectiveness is so modest, individual autonomy is surely not at risk. We too recognise the limits of influencing. Nonetheless, it seems appropriate to sound a warning in respect of future developments. After all, experimentation, learning and manipulation are constantly being practised on a huge scale, resulting in an ever greater pool of knowledge about people and their behaviour. To paraphrase the words of the often heard advertising footnote, past results are no guarantee for a worry-free future.

Acknowledgements

Method

For this study, we made use of international literature in the field of influencing online behaviour. We also analysed 32 apps with clear links to mobility. The selection reflects the wealth of mobility apps, and is not necessarily representative for actual use. On each occasion, the analysis consisted of a set of fixed control points and interventions. For each app, we also considered whether other researchers had possibly already analysed these aspects. The insights that emerged from our study specifically represent a snapshot in time; after all, the digital world is in a constant state of flux. Since we conducted our study, the appearance of many of these apps has already changed.

Background report

For more information on the method used and the results, consult the background report that can be downloaded via the website www.kimnet.nl

Zijlstra, T. and Huang, B. (2023). *Online beïnvloeding van het reisgedrag*. Background report. The Hague: Netherlands Institute for Transport Policy Analysis (KiM).

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