Interventions as Soft Policies to Support Sustainable Behavior

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Abstract² It is not always easy for consumers to estimate ecological factors of products. These characteristics of products from production to disposal are trust FKDUDFWHULVWLFV EHFDXVH consumers WKH\ ³DUH QRW IRUHKHDG´ In few consumption areas eco-labels are established, e.g. food. In others, they are not, e.g. transportation. There is a need of transparent and believable information to teach consumers. Information, training and education can empower people to make well-founded decisions. In many social groups (sinus milieus) informing is not enough. The awareness of sustainability is quite low and additional measures needed. Motivation, reflexion, coinage and economic benefits are the key to get these people to act more environmental-friendly. Measures like these are soft policies in the field of transportation and mobility. There are no restrictions or changes to the infrastructure. Soft policies are implemented much faster and with lower financial investment. In 1993 Dwyer et al. investigated different types of soft policy measures to preserve the environment, so called interventions to change individual behaviour and decisions and diffusions to spread changes into community and to penetrate all social groups More than a quarter century later digital mediums and a high level of social connection and interaction opened up new ways to intervene and diffuse. This paper presents new formats based on the development of 1993 tested formats. Formats are compared to Dwyer et al., Mosler and Schade.

Index Terms² Sustainability, transportation, consumer behavior, soft policy, nudging, gamification

I. Review of Existing Formats to Influence Human Behaviour to a More Sustainable One

First, this paper summarizes previous research about decision-making and interventions to adapt decisions and behaviour.

Intervention formats in relation to behaviour and decision-influencing factors have been researched extensive.

According to relevant factors influencing a decision, the intervention format can be chosen. No theory noting all factors and facets of human behaviour and especially environmental human behaviour is known. When investigate different theories and models of decision making, like Theory of Planned Behaviour [1], Rational Choice Theory [2], models from transportation planning [3], norm-activation-model [4] and consumption theory [5] six areas to influence decisions for or against a mode of transport can be identified. These are

- Rational aspects: greatest benefit, lowest cost
- Awareness of behavioural consequences and responsibility
- Subjective attitudes
- Social norm
- Perceived behavioural control
- Responsibility norm/personal norm

³7KH HIIHFWLYHQHVV RI EHKDYLRXUDO LQWHUYHQWLRQV generally increases when they are aimed at important antecedents of the relevant behaviour and at removing barriers to change. Therefore, it is important to understand which factors promote or inhibit HQYLURQPHQWDOO\ EHKDYLRXUDO LQWHUYHQWLRQV should be designed according to the characteristics of individual behaviours> « @´ >

Even if environmental awareness is an increasing value in western societies [8], mainly in the liberal intellectually, socio-ecological and hedonistic milieus, there is a gap between environmental awareness and environmental behaviour. This gap is called dilemma of the commons and describes the conflict of individual, mostly short-term needs and collective long-term demands.

The upcoming challenge is to meet the gap between awareness and behaviour. A well-known method to do so, is an intervention.

Since the 1970s intervention formats have been tried and tested. Dwyer et al. [9] reviewed 54 studies about interventions. They were able to sort different types of interventions:

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- Commitment from the individual to engage in some target behavior
- Oral information that provides knowledge
- Written information that provides knowledge
- Assigned individual goal for engaging in some target behavior
- Environmental alteration refers to designing a part of the environment in a way that forces a target behavior

All interventions use three general approaches. The use in decreasing frequency: reward (52%), feedback (41%), penalty (7%).

Schade came to similar results. He differentiated measures to change mobility behaviour into hard and soft policies. Hard policies are for example a change of infrastructure or restrictions, soft policies are measures of education, information and training and economic benefit systems.

When considering the soft policies, comparable structures to Dwyer are visible.

Soft policy measures also use information and rewards [10].

Mosler [11] categorized soft policies in different intervention formats that have strong resemblance to Dwyer et al. Intervention formats are

- Written, drawn or spelled hints
- Self-commitment
- Role model behavior
- Feedback and self-monitoring
- Persuasion

These intervention formats are able to influence and change human mobility decisions and behaviour on an individual level. Mosler also investigated how to spread changes on individual levels to a common one in whole society. He identified different diffusion formats to penetrate all social groups (not only those that are aware of environment yet):

- Multipliers
- Activators
- Passing on and sharing tasks
- Collective actions
- Media actons

With combination of interventions and diffusions, behavioural changes should be able to reach all social groups.

Other works, such as Moore and Boldero [7], which looked at interventions by political decision-makers, came to comparable conclusions.

This work relates intervention formats to the different degrees of environmental awareness in the sinuses of Western societies.

Generally, intervention formats can be grouped into interventions with the aim to inform, educate and train and interventions with the aim to give feedback, reflexion, characterization and economic benefit.

Considering the different social groups, interventions target different goals. In social groups with high awareness of the environment, measures to inform, educate and train in environmental effects of transportation can reach the goal to change behaviour. In social groups with lower awareness, measures to give feedback, reflexion, characterization and economic benefit are needed. Nevertheless, in all groups the second type of measures are estimated as successful. It is not only about informing, but also about motivating.

Since the studies in the 70s, 80s and 90s over a quarter century has passed. Former interventions formats used former technologies and media. Translated into the present age there are new media and canals to bring in knowledge and feedback, rewards and penalties.

The following chapter gives an overview of 21st century media, canals and technology to diffuse interventions. The third chapter designs a contemporary instrument to intervene mobility behaviour and the last one explains a field study according to Dwyer to prove the developed intervention instrument.

II. 21st Century Techniques ± Reviewes Formats Under Current Aspects

A. Uni- and Bidirectional Communication in Changing Times

Since the release years of previous presented research, a few noticeable developments and new techniques arose. Related to this work the founding of the internet, smartphones and the increasing access to audio-visual media are relevant.

The channels to distribute hints, graphics, spoken sentences, rewards and so on were strongly limited 25 years and longer ago. In these times print media, radio broadcast and television were the primary media to reach people. Interaction between an author, speaker or actor was not possible, it was a one-way unidirectional communication. That is a characterising fact of interventions at that time. Persons were able to consume media only in a passive way. With development of the internet, a new communication came up. It enabled a bidirectional, interactive communication between the scoop of contents and the consumer of contents and further on between consumers too.

That changes the way interventions can be implemented and how they work. Feedback can be given in time, personalized and flexible to reactions. Rewards can be shared, collective actions can be planned and tracked by groups from any place at any time. Role models can reach more people with help of social media, self- commitment can be monitored with current data and reached goals can be shared with others.

This reinforces some factors as follows:

- Awareness of behavioural consequences and responsibility: with help of artificial intelligence H Y H U \ R Q H ¶ V R Z Q E H K D Y L R X U F D Q pictures, animations and so on and the awareness of consequences and responsibility can be trained in a gaming way
- Social norm: sharing goals, successes, failures, challenges, common tasks and some other with friends and societies activates the social norm

- Perceived behavioural control: everyone is qualified to control decisions and experiences
- Responsibility norm/personal norm: with help of interactive communication between an always-there-guy (virtual) and an emotive relation between an user and a media tool, attitudes, personal values and norms can change because of an long-term interaction

Interactive communication also strengthens interventions formats like feedback and self-monitoring, self- commitment (permanent tracking of goals and behaviour and in-time alignment if goals can be reached to motivate the addressee of the intervention).

The following subchapter presents 21st century media formats and an evaluation of usability to intervene mobility behaviour.

B. Evaluation of Media Formats to Intervene Mobility Behavior

Although media can be clustered at different levels of interactivity, the assignment is not always unique. If no interactivity or only individual interactive elements are given, these media are assigned to the passively consumed media in this paper. These do not provide a direct exchange between sender and receiver of a content.

1) Passive consumed media

Print-media: Print media have an interactivity level of zero. Magazines, newspapers, books, catalogues, plans, posters or brochures are classic. Advertising covers a wide range as well as grey literature.

Print media fulfil only a few of the purposes required for the instrument of suggestion. The absence or partial presence of interactive elements is considered a disadvantage in relation to Roznawski [12]. Print media can convey content, but they do not offer reflection, further communication or a deeper level of relationship between the user and the content.

Digital, passive-consumed, screen-related media, excluding audio-visual media, websites, apps and games: This includes primarily e-books, blog posts, online magazines, podcasts and audio books. These are mainly digital print media and converted forms of print media. In addition, this field also includes parts of the new media that have become possible thanks to digitization.

However, since these do not differ significantly from the print media either in terms of function or in terms of consumption, they must be adequately evaluated.

Audio-visual media: Audio-visual media are synchronous means of communication that serve both the visual and the auditory sense of man through image and sound. Audio-visual media are available in analogue and digital form.

They offer no or limited interaction. Audio-visual media usually only become interactive through distribution or publication via websites. Examples are the video platform YouTube or a streaming service like Netflix.

Audio-visual media are similar to print media. Nevertheless, communication takes place via more senses than with print media and can therefore have a different effect under certain circumstances.

Broadcast: In broadcasting, information of any kind (sound, image, text, data) is transmitted via electromagnetic waves. Broadcast media are radio and television.

Broadcasting does not provide an immediate means of communication. The level of interactivity is low. Therefore, like the print media, it is disadvantaged and unsuitable as an instrument of suggestion.

Information event: In contrast to an action event, an information event does not offer the possibility of exchange, communication and interaction. This type of event merely serves to inform the visitor and to transmit content.

This medium is therefore of no interest as an instrument of suggestion.

2) Interactive-consumed media

Due to their level of interactivity, the media were classified as interactively consumed and passively consumed media. A medium is classified as interactive if it enables direct bidirectional communication. Individual media may have interactive elements, for example, the possibility of a listener call in radio broadcasting, but are not classified as such based on these individual elements, but are assigned to passive consumed media.

The possibility of interactivity is regarded as a decisive feature, since it has been proven that interactive content can activate the user cognitively and motivatively to a greater extent than passive content.

Website: The function of digital media is based on digital information and communication technology. The Internet as such is a digital and interactive medium. Contents can be transmitted via websites.

A website is able to present user-oriented content, i.e. to react to wishes, inquiries or needs. In addition, complex algorithms can be implemented on websites, which the user can control by means of operating screens. It is therefore possible to convey complex content.

Web pages can be visited with any Internet-enabled device, provided it is received. Web pages can be browser- or mobile-optimized, depending on which device is used to access them. Mobile websites are preferred for access independent of time and place.

Digital media offer the following advantages:

- Easy to use
- Easy scalability
- Easy distribution / easy access
- Low marginal costs
- Long range
- Easy adaptability
- Easy integration of existing data

Mobile application: In this case, a mobile application is almost synonymous with mobile-optimized websites. However, an app can have advantages in terms of usability and usability, which is why it would generally be preferable to mobile websites. Tosic [13] considers smartphones to be particularly suitable marketing instruments for climate protection marketing. The personal relationship between the device and the user through the permanent carrying with them enables an intimate and emotional level.

Computing and console game: Computer games are suitable for performing educational tasks and conveying content. "Just as communication between the author and the reader takes place through the reading of a book, such takes place between the developer and the player in a computer game." [14]

Wimmer also came to the conclusion in his investigations that computer games are suitable at least to draw attention to educational content and that this potential should be further empirically investigated against the background of decreasing accessibility of children, adolescents, people with disabilities and migration background through public broadcasting [15].

Although the learning effect of computer games has not yet been fully proven, it seems sensible to consider the idea for the further development of the instrument. Due to the lack of proven learning success and the range of content to be transmitted, a computer game itself will not suffice. Therefore, this may be an addition.

Action event: In contrast to a pure information event, an action event enables a communicative exchange. Suitable formats create interaction between visitors and organisers, experts, lecturers, exhibitors and others.

An action event can be an effective tool for transmitting content and can provide an impetus for discussion of a topic or act as a climax of an ongoing debate. However, an action event alone does not seem sufficient, as it is a one-off, non-permanent measure that lacks linearity. This medium can therefore only be an additional instrument in its intended application.

3) Evaluation of media formats

The following Table I shows the evaluation of the previous named media based on the six in chapter 1 presented decision-influencing areas.

TABLE I. EVALUATION OF MEDIA FORMATS

	Indivudual benefit maximization	Awareness raising	Influencing subjective attitudes	Activation of social norm	Perceived behavioral control	Personal norm	Evaluation
Interactive-consumed media							
Website	1	1	1	1	1	1	6
Mobile application	1	1	1	1	1	1	6
Computer and console games	0*	1	1	1	1	1	5
Campaign event	0	1	1	1	0	1	4
Passive-consumed media							
Print meda	0	1	1	0	0	0	2
Audiovisual media	0	1	1	0	0	1	3
Broadcast media	0	1	1	0	0	1	3
Digital media	0	1	1	0	0	0	2
Information event	0	1	1	0	0	0	2

The evaluation of the possible media with regard to the tasks to be performed in line one identifies web pages and mobile applications as the best possible medium, as they each enable all functions and tasks. A mobile application is to be favored due to the better operability and usability, from mobile terminals.

While at the time of the above-mentioned studies it was very limited how an intervention was transmitted, today's technologies and networks offer new possibilities.

The up-coming tool for intervention and related suggestion of new mobility decisions and behaviour can use digitization, integration of games, rewards, in-time feedback, audio-visual media and connection to additional media like events to reach the addressee in different ways and diffuse changes of behaviour into society just in-time and with usage of emotional ways of transferring data like video files, pictures and so on.

III. USING NEW MEDIA TO IMPLEMENT INTERVENTION AND DIFFUSION FORMATS

As described before 21st century technology offers completely new ways of interventions. In previous times, interventions were more static and could not develop their own dynamics.

Table II shows a comparison of intervention formats and soft and hard policy measures of Dwyer et al. [9], Schade [10], Mosler [11] and the developed tool of Heckmann.

TABLE II. EVALUATION OF MEDIA FORMATS

Dwyer et al.	Mosler	Schade	Heckmann	Goal
		Hard policies		
Penalties	-	Regulatory measures	-	Punish unwanted behavior, threaten punishments to prevent this. Prevent unwanted behaviour through laws, guidelines, etc. or steer ehaviour in the opposite direction.
-	-	Offer design	-	Changing not the demand side, but the supply side
		soft policies / ways to intervene		
Commitment from the individual to engage in some target behavior	Self-commitment	-	Personal challenges and reporting about successfull challenges, goal-reaching barometer	Voluntary agreement: What is my goal? Control wheter I can achieve this necessary
Oral information that provides knowledge	Written, drawn or spelled hints	Training, education and information measures	Transfer of emission values to inform about environmental consequences, pictorial, methaphorical transfer and presentation for a better understanding of complex facts.	Information, education training as a basis for further measures
Written information that provides knowledge				
Assigned individual goal for engaging in some target behavior	-	-	Digital, connection, sharing of results/ successes with others to U H O D W L Y L] H behaviour to common behavior	What can each individual achieve so that a certain change can be achieved in the collective?
Environmental alteration refers to designing a part of the environment in a way that forces a target behavior	-	-	Transfer of the results into an virtual reality to show effects of behavioural changes	0 D N H R Q H µ V R Z Q F R Q W U L E X
rewards	-	Economic incentive systems	Benefity- system with collecting eco-points and reinvest in coupouns and vouchers	Reward desired behaviour, set incentives for it
Feedback	Feedback and self monitoring	-	Reporting-area giving feedback and tips, monitoring scales	Provide information about previous behaviour, tips for improvement, S R V V L E L O L W \ W R F R Q W U R O R behaviour
-	Role-model behaviour	-	Using social media to follow favourite people and getting informed about there behaviour using celebreties to diffuse desired behaviour	To have a role model on which one can orient oneself. Let desired behaviour be exemplified by the role model in order to encourage imitation
-	Persuasion	-	A mobile app itself acts as a communicator	Using a communicator to disseminate information, data, goals and more

Hard policies are only included in the work of Schade and in two studies Dwyer investigated, in form of penalties and regulations and in designing the offering side.

Soft policies are equal to intervention formats. All studies from Dwyer [9], the works of Schade [10], Mosler [11] and the new tool of Heckmann focus these measures. There are parallels at commitment, information giving, rewarding and giving feedback. Other ways of intervene are not included in more than two of these researches: individual goals, environmental alteration, role models and persuasion.

The new intervention and suggestion mobile app from Heckmann pick up all ideas and investigated methods of

intervention and brings them together. That allows a holistic influencing of mobility behaviour. Besides an app offers additional advantages.

The special relationship between people and their smartphones, the emotional interaction, helps to transfer interventions and creates a higher success. Interventions are independent of people coordinating, planning, giving hints. A mobile application is flexible, builds a personal level to the addressee, learns from him, adapts habits, wishes and experiences, incorporates personalized data and live data and combines the previously separate and independent intervention and diffusion formats into a holistic overall intervention and suggestion tool.

The mobile app has answers to all six influencing areas, shown in chapter 1. Fig. 1 shows the functions of the mobile app depending on the six influencing areas.

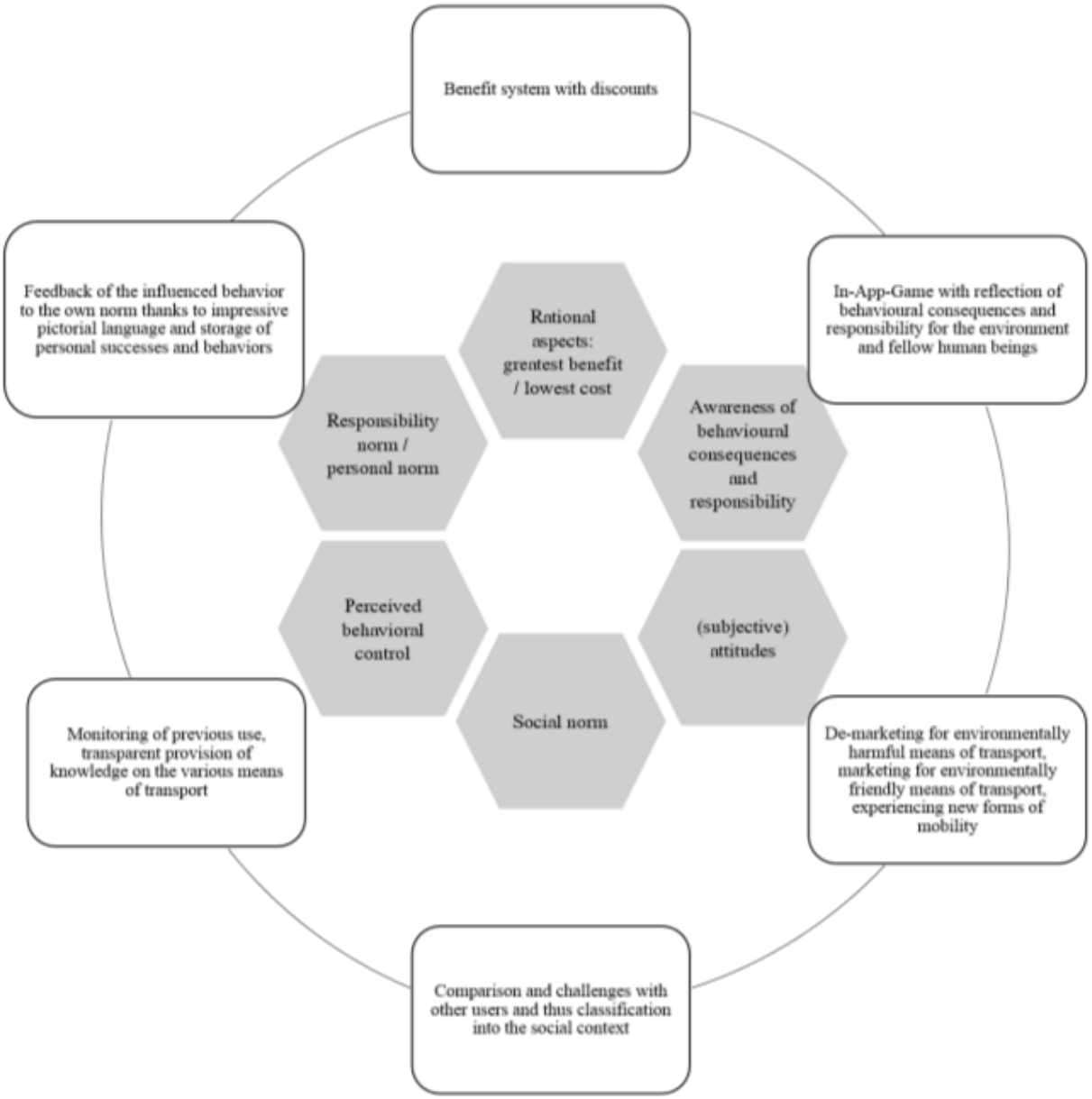

Figure 1. Functions of the app depending on the means of transport selection parameters

When using this mobile app, users will learn more about transportation emissions, consequences of their own mobility behaviour (as studies have proven there is a big deficiency) and getting ideas of a new mobility behaviour. Reflexion and coinage strengthen a long-term sustainably mobility routine. The overall goal is that interventions create a permanent change in behaviour of transport users. When stopping the interventions, the level of emission producing will decrease further on, the level of sustainable awareness will increase continuously. This would prove that the interventions have not only had an effect at the time they are implemented, but have also had a lasting effect on consciousness.

IV. A Field Study to Verify New Media Interventions and Diffusions

The design of the field study is based on the one of Dwyer et al, which is empirically proven. Individual structures were changed.

First, a random sample of the population is written to and asked to participate in the field study. Those who agree to participate are randomly and evenly distributed among trial group 1, trial group 2 and a control group.

The field trial was conducted over a period of sixteen weeks. The first four weeks form the baseline phase. The following eight weeks were the suggestion phase. The last four weeks are the follow-up phase.

An extensive survey is carried out at the beginning of the study:

- Personal data (anonymised)
- Degree of sensitivity to environmental issues and mobility behaviour as well as other environmental psychological data
- Current mobility behavior
- Data for grouping in a sinusoidal environment

Subsequently, in the baseline phase, the mobility behaviour of the test persons of all three groups is recorded by means of a mobility diary and relevant variables are derived from this.

After the baseline phase, another survey is conducted at the beginning of the fourth week, adequate to the survey described above, in order to generate a second data set.

At the same time, experimental group 1 also starts using the suggestion instrument, which exclusively offers information, training and education (app with limited functionality). Experimental group 2 starts synchronously with the use of the app including all offered incentives, i.e. also with motivation, reflection and imprinting (app with full functionality).

Over a further eight weeks, the mobility behaviour is recorded in a mobility diary in the suggestion phase. At the end of the trial period, the survey is carried out for the third time. Experimental groups 1 and 2 end the use of the app.

This is followed by the four-week follow-up phase, at the end of which the fourth and last survey takes place.

Based on the evaluation of the mobility diaries and the four comparative surveys at the beginning, after four weeks, after twelve weeks and at the end after sixteen weeks, it will be evaluated whether the mobility behaviour has changed, whether emissions have been saved as a result and whether the environmental awareness and awareness of one's own mobility behaviour among the test persons in the test groups has increased over the period of the study. Fig. 2 shows the experimental design of the study.

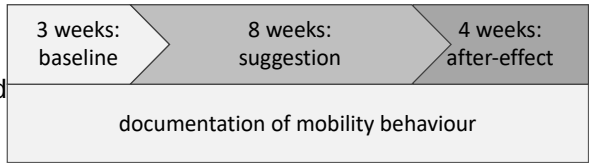

Figure 2. Experimental design

Fig. 3 shows the expected developments of the emissions of the three different groups of test persons.

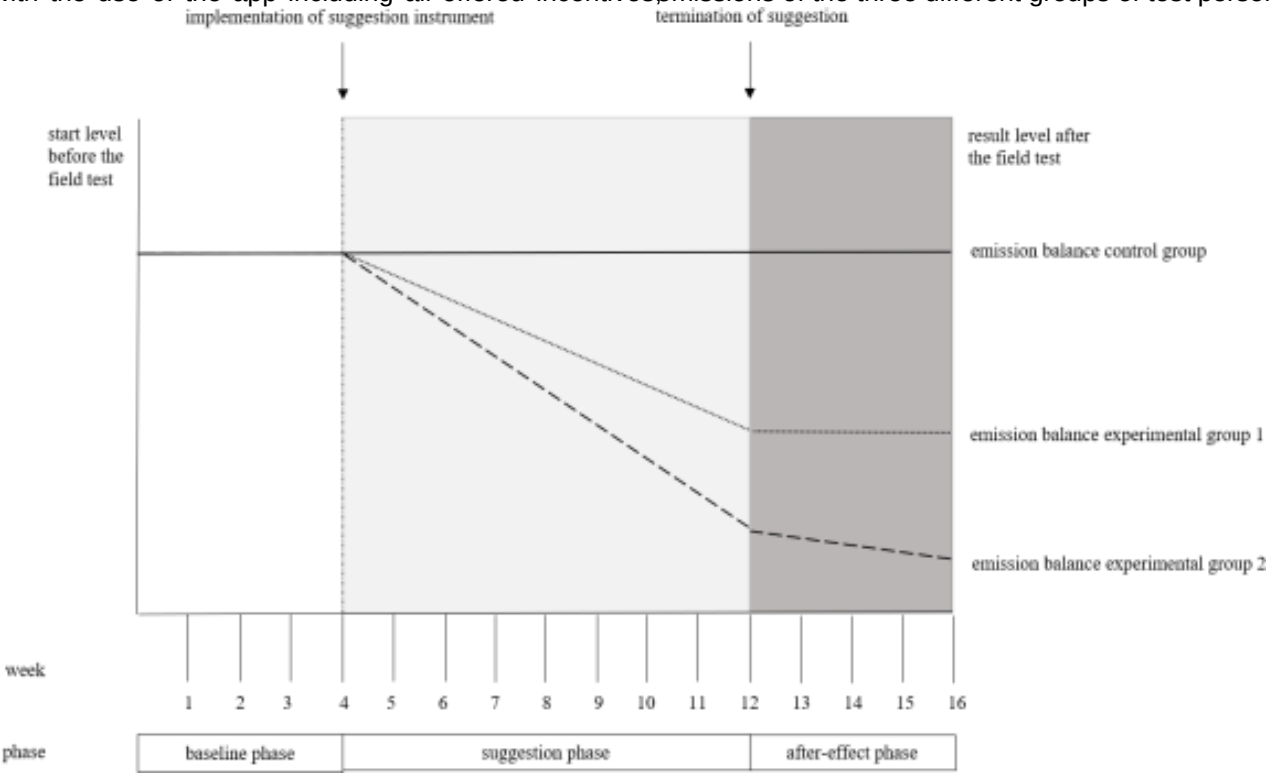

Figure 3. Change in the emissions balance of the control group 1 and test group 2 represented in an ideal typical manner

Fig. 4 shows this for the development of environmental awareness. These graphs are then compared with the data from the evaluation of emissions and environmental awareness.

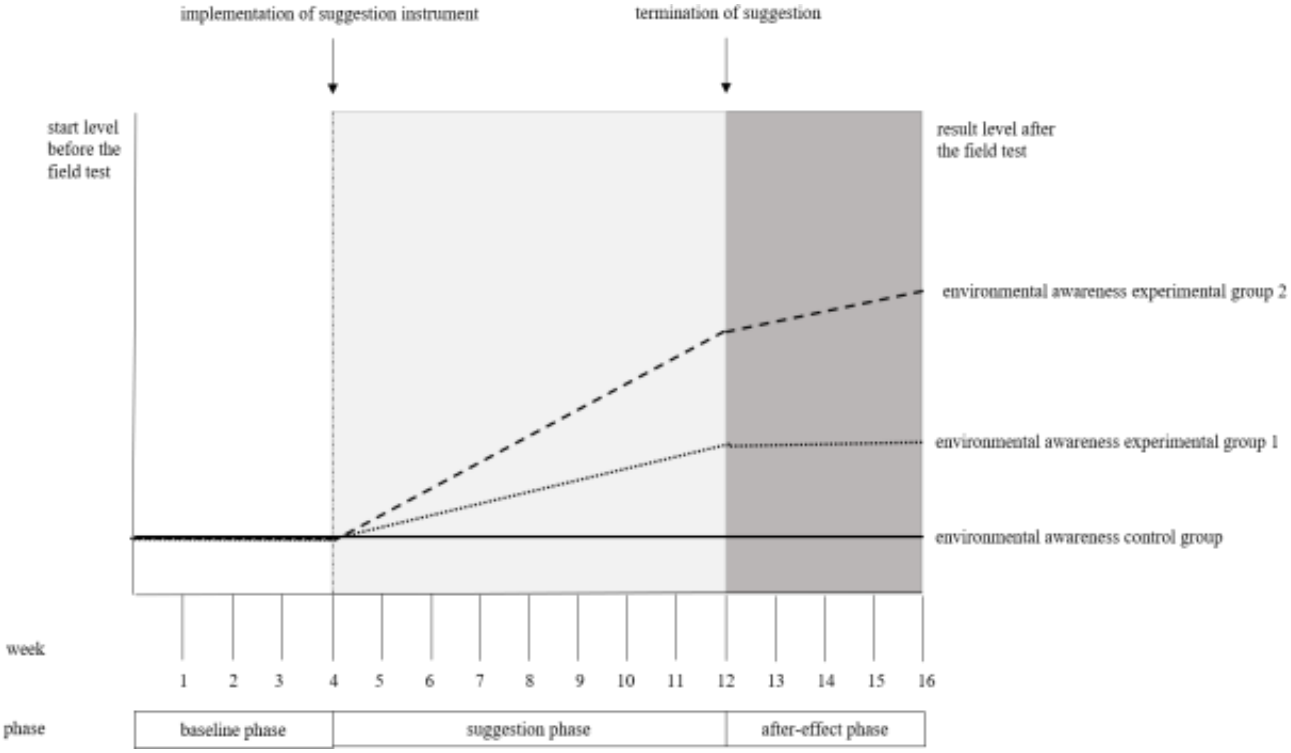

Figure 4. Ideal-typically represented change in environmental awareness of control group, test group 1 and test group 2

With the introduction of suggestion, the emission decreases in test groups 1 and 2 and remains at a lower level in test group 2, which made full use of the app, even after the suggestion has been aborted. The emission of test group 1, on the other hand, increases again. The emission balance of the control group remains at the same level over the entire duration of the field study. The success of the suggestion is determined by a statistically verified comparison of the emission values between the test group and the control group as well as to the previous surveys. The success of the additional functions of the app of test group 2 compared to test group 1 is measured adequately.

At the same time, statements can be made about changes in environmental awareness. The control group's environmental awareness remains unchanged over the period of the study. In test group 1, it increases in the suggestion phase, then stagnates in the after-effect phase as soon as the suggestion has been completed. On the other hand, in experimental group 2, environmental awareness increases further in the after-effect phase, but less steeply.

With the aid of this experimental design, the effectiveness of the suggestion measures of the app is examined. The design also compares the effectiveness of pure information, training and education to the effectiveness of additional motivation, reflection and incentives.

V. Conclusion

Interventions are a method to influence mobility behaviour on demand side, in opposite to hard measures on the offering side.

Soft policies, how interventions are which ones, do not work with prohibitions or penalties, but with incentives, clarification and motivation.

This research adapted intervention formats to today's times and the associated state of the art. It has looked at studies and reviews between 1970 and 1990 and has presented differences and parallels between forms of intervention and soft policies. From this, an intervention and suggestion tool was derived, which contains these and generates a combinatorics.

The experimental design, which Dwyer empirically tested, was further developed and a proposal made for testing the newly developed tool. Further research can use this experimental design to investigate intervention tools and generate comparable data that can be used to examine and compare the effectiveness of tools. The present tool itself is tested with the developed test design. For comparison, analogous interventions can be investigated to find out whether the new tool has advantages.

It is expected that the tool can successfully influence mobility behaviour in a targeted direction and that the developments shown in Fig. 3 and Fig. 4 will be almost achieved.

Conflict of Interest

There is no conflict of interest.

Author Contributions

Rebecca Heckmann was responsible for the research and analysis of literature and wrote the paper. Together with Sören Kock, she carried out the investigation of media formats and their evaluation. Lutz Gaspers and Jörn Schönberger are the creative minds behind the

project, supervising the scientific evaluation and revising the content of the paper. The linguistic revision was carried out by Sören Kock.

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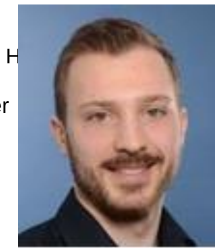

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