

University of Groningen

The effects of a financial incentive on motives and intentions to commute to work with public transport in the short and long term

Zeiske, Nadja; van der Werff, Ellen; Steg, Linda

Published in:
Journal of Environmental Psychology

DOI:
[10.1016/j.jenvp.2021.101718](https://doi.org/10.1016/j.jenvp.2021.101718)

IMPORTANT NOTE: You are advised to consult the publisher's version (publisher's PDF) if you wish to cite from it. Please check the document version below.

Document Version
Publisher's PDF, also known as Version of record

Publication date:
2021

[Link to publication in University of Groningen/UMCG research database](#)

Citation for published version (APA):

Zeiske, N., van der Werff, E., & Steg, L. (2021). The effects of a financial incentive on motives and intentions to commute to work with public transport in the short and long term. *Journal of Environmental Psychology*, 78, [101718]. <https://doi.org/10.1016/j.jenvp.2021.101718>

Copyright

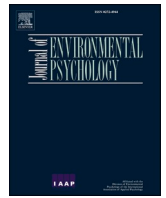
Other than for strictly personal use, it is not permitted to download or to forward/distribute the text or part of it without the consent of the author(s) and/or copyright holder(s), unless the work is under an open content license (like Creative Commons).

The publication may also be distributed here under the terms of Article 25fa of the Dutch Copyright Act, indicated by the "Taverne" license. More information can be found on the University of Groningen website: <https://www.rug.nl/library/open-access/self-archiving-pure/taverne-amendment>.

Take-down policy

If you believe that this document breaches copyright please contact us providing details, and we will remove access to the work immediately and investigate your claim.

Downloaded from the University of Groningen/UMCG research database (Pure): <http://www.rug.nl/research/portal>. For technical reasons the number of authors shown on this cover page is limited to 10 maximum.



The effects of a financial incentive on motives and intentions to commute to work with public transport in the short and long term

Nadja Zeiske, Ellen van der Werff^{*}, Linda Steg

Department of Psychology, University of Groningen, Groningen, the Netherlands

ARTICLE INFO

Handling Editor: Sander van der Linden

Keywords:

Financial incentive
Motives
Intrinsic motivation
Public transport use

ABSTRACT

The present research aimed to evaluate the effectiveness of a three-week free public transport card in encouraging people to commute to work using public transport both in the short term (while the incentive is in place) and long term (after the incentive is removed). Moreover, we tested effects of the free public transport card on motivations to use public transport. Findings from our longitudinal field study showed that participants had strong intentions to use public transport while the incentive was in place, but intentions to commute to work using public transport decreased in the long-term, suggesting that the incentive was effective while in place, but not when it was removed. Moreover, participants rated the financial motives to commute to work using public transport as less important after the incentive was removed, suggesting that financial incentives provide people with a temporary motive to engage in the desired behaviour, which may explain the short-term effectiveness of the incentive. We did not observe that the free public transport card crowded out participants' intrinsic motivation to travel by public transport. Theoretical and practical implications are discussed.

1. Introduction

Mitigating climate change requires people to consistently engage in pro-environmental behaviours (IPCC, 2018). To this end, interventions and policies are being implemented to motivate such behaviour. Pro-environmental behaviours are oftentimes somewhat costlier or more effortful than their conventional counterparts. Thus, a common approach to encouraging pro-environmental behaviour focuses on enhancing the individual outcomes of the behaviour and reduce the associated effort and costs. In particular, a common approach is to introduce some type of a financial incentive. Financial incentives may encourage people to try out and become familiar with new behaviours, and motivate people to adopt such behaviours in the long-term. Examples are introducing financial rewards to encourage people to conserve energy and free bus tickets to encourage people to try out public transport (Bamberg, 2006; Van Der Linden, 2015). Such strategies indeed promoted the target pro-environmental behaviour in the short-term, yet, financial incentives may not always result in the desired consistent long-term behavioural changes (Bolderdijk & Steg, 2015; Bolderdijk et al., 2011; Maki et al., 2016). That is, once the incentive is discontinued, few studies have found maintained behavioural changes (Maki et al., 2016; Thøgersen, 2009), while most have found that

behaviour returns to baseline levels (Bolderdijk & Steg, 2015; Bolderdijk et al., 2011; Everett et al., 1974; Kaiser et al., 2020; Van Der Linden, 2015). Yet, financial incentives are often removed after a certain period of time because it is not feasible or too expensive to keep the incentive in place. Given the long-term behavioural changes that need to take place in order to mitigate environmental problems, it is important to understand whether or not financial incentives are effective tools in stimulating maintained behaviour change, once they are removed. Furthermore, it is important to study why financial incentives may or may not lead to maintained behaviour change, as this may provide important insights into how to improve incentives in such a way that they can also result in long-term behaviour changes.

Two lines of reasoning have been proposed to explain why financial incentives may not result in long-term behaviour change once the incentive is removed. First, financial incentives provide individuals with a temporary motive to engage in the behaviour – that is, a temporary financial benefit. Once the incentive is removed, however, so is the financial reason to engage in the behaviour, which may in turn inhibit sustained behaviour change (Bolderdijk & Steg, 2015).

A second line of reasoning stems from the motivation literature, which suggests that financial incentives may undermine people's intrinsic motivation to engage in the desired behaviour. It has been

^{*} Corresponding author. University of Groningen, Grote Kruisstraat 2/1, 9712TS, Groningen, the Netherlands.

E-mail address: ellen.van.der.werff@rug.nl (E. van der Werff).

suggested that intrinsic motivation in particular is an important source for maintained behaviour change, as in this case people engage in the behaviour because they want to do so out of their own conviction. Undermining intrinsic motivation may thus hinder long-term behaviour change and may even make people act less pro-environmentally after incentives have been removed (Deci et al., 1999; Frey, 1994, 1997; Gneezy et al., 2011; Steg et al., 2016).

Surprisingly, past studies did not explicitly test why incentives did not always result in sustained changes in pro-environmental behaviour after incentives have been removed. Hence, the question remains to what extent both processes discussed above play role in explaining short and long-term effects of financial incentives. Understanding the underlying process may provide important insights into how (long term) effects can be enhanced. With this in mind, the present research aimed to evaluate the short term (when incentive is in place) and long-term effectiveness (after the incentive is removed) of a financial incentive, and examine the underlying factors that may play a role in both its short and long-term effectiveness. In the following sections, we further elaborate on the two lines of reasoning explaining why financial incentives may or may not be effective tools in encouraging maintained pro-environmental behaviour change even when the incentive is discontinued. Subsequently, we present the results of our longitudinal field study that aimed to test the short-term and long-term effects of a financial incentive, as well as the underlying process.

1.1. Financial incentives provide a temporary motive to engage in pro-environmental behaviour

Financial incentives may provide people with an additional motive to engage in behaviour that they otherwise would not perform. Specifically, a financial incentive can make behaviour more attractive to engage in as it provides additional financial advantages. However, once the incentive is removed, the previously financially beneficial aspect of the desired behaviour is no longer present, and for this reason, financial incentives may have little to no lasting effect after they are discontinued (Bolderdijk & Steg, 2015; Bolderdijk et al., 2011; Everett et al., 1974). Indeed, a field study found that a discount on young drivers' insurance premium, that aimed to encourage them to reduce their speeding behaviour, was an effective incentive (Bolderdijk et al., 2011). However, once the discount on the insurance premium was no longer offered, participants increased their speeding behaviour again to baseline levels. The authors reasoned, but did not test, that the discount on the insurance premium posed a temporary financial reason for the young drivers to reduce their speeding behaviour. Once the discount on the insurance premium was no longer offered, the young drivers had no reason to continue to reduce their speeding behaviour anymore, and thus behaviour returned to baseline levels.

Yet, the introduction of a financial incentive may also lead people to discover, or reconsider, other beneficial aspects of engaging in a certain behaviour. For example, by engaging in the incentivized behaviour people may realize that the behaviour is beneficial for the environment, or that it is more convenient than expected. In turn, these other aspects may become additional important motives for individuals to continue to engage in the desired behaviour, even after the financial incentive is no longer in place. Thus, although the financial motive may be temporarily important, other motives may remain important after the incentive is discontinued, and be the driver for long-term behaviour change. There is some empirical evidence to support this argument (Fujii & Kitamura, 2003; Thøgersen, 2009). A study evaluating the effectiveness of a free one-month public transport travel card in encouraging individuals to take public transport to commute to work instead of their car found that this incentive was not only effective in encouraging individuals to try out public transport when the incentive was offered, but some participants continued to use public transport after the free month trial had ended (Thøgersen, 2009). The author reasoned that by trying out public transport, participants experienced other positive consequences they

may not have expected beforehand, thereby acknowledging other reasons to continue to commute to work with public transport in the long-term, even after the financial benefits were no longer in place. Hence, financial incentives may result in continued changes in behaviour, even after the incentive is removed, when people discover additional important motives for engaging in the desired behaviour, which they did not acknowledge before the incentive was in place.

The reasoning implies that financial incentives may have long-term effects when people experience additional benefits which implies that other motives become more important. Although this line of reasoning has often been inferred when explaining the findings of previous research, previous studies have not explicitly tested this line of reasoning. We aim to address this gap in the literature by explicitly testing whether the introduction of a financial incentive affects the importance of financial as well as other motives. Specifically, if financial motives are rated as more important while the incentive is in place, compared to before or after the incentive is removed, we would not expect long-term behaviour change effects. Yet, if the introduction of a financial incentive leads people to acknowledge additional benefits, through which other motives to engage in the behaviour may become important, we would expect long-term effects in behaviour change.

1.2. Financial incentives may crowd out intrinsic motivation to engage in pro-environmental behaviour

A second account of why financial incentives may not result in lasting behaviour changes after they are discontinued proposes that financial incentives may undermine intrinsic motivation to engage in the desired behaviour (Deci et al., 1999; Frey, 1994; Frey & Oberholzer-Gee, 1997; Van Der Linden, 2015). When people are intrinsically motivated, they engage in behaviour because it is inherently enjoyable to do so (Deci et al., 1999), or because it is personally meaningful, and because it is the right thing to do so (Steg et al., 2016; Van der Werff et al., 2013; Venhoeven et al., 2020). Engaging in pro-environmental behaviour means engaging in behaviour that is in line with the moral value that upholding and protecting the environment is the right thing to do. Interestingly, people all over the world generally find it important to protect nature and the environment (Bouman & Steg, 2019; Jakovcević & Steg, 2013). This suggests that it is likely that they engage in pro-environmental behaviour because they are intrinsically motivated to do so, as they consider this to be the morally right thing to do.

When people are extrinsically motivated, they engage in actions for external reasons or to attain a separable outcome, such as for a financial reward (Ryan & Deci, 2000). It has been argued that financial incentives can undermine or crowd out intrinsic motivation, as they make people engage in pro-environmental behaviour for extrinsic reasons, namely for the financial reward, and no longer because it is the right thing to do (Bolderdijk & Steg, 2015; Frey, 1994; Gneezy et al., 2011). Financial incentives may thus weaken people's intrinsic motivation to engage in the pro-environmental behaviour. When the financial incentive is discontinued, the extrinsic motivator to engage in the behaviour is removed. At the same time intrinsic motivation is still weakened, implying that behavioural changes are not maintained. It may even imply that people engage in the behaviour less than before the financial incentive is introduced, because they are no longer intrinsically motivated to do so (Bolderdijk & Steg, 2015; Deci et al., 1999; Frey, 1997). Scholars have reflected on how the crowding out of intrinsic motivation may also explain why financial incentives may be not effective in the long-term (Deci et al., 1999; Frey, 1994; Gneezy et al., 2011; Van Der Linden, 2015). However, these studies have not directly tested whether intrinsic motivation was indeed weakened when an incentive is introduced. Extending previous research, the present research aimed to explicitly test whether intrinsic motivation is undermined when a financial incentive is introduced, and whether this can explain why behaviour changes are not sustained after the incentive is no longer in

place.

1.3. The current research

The present research aimed to examine the effectiveness of a financial incentive in encouraging pro-environmental behaviour both while the incentive was in place, and after it was discontinued relative to before the incentive was offered. Specifically, we studied the effects of a three-week free public transport card that aimed to encourage people to commute to work using public transport both while the incentive was in place and after it was discontinued, by comparing it to the before measure. To this end, we examined the influence of a three-week free public transport card on people's intentions to commute to work using public transport instead of their cars. Moreover, we examined self-reported past commuting behaviour as well as actual commuting behaviour during the intervention period to make inferences on the effectiveness of such an incentive on actual behaviour.

Furthermore, and extending previous research, we tested the underlying processes that may explain whether or not a financial incentive may (also) result in long term effects, after the incentive has been removed.

First, we tested whether the financial incentive affected the importance of different motives people have to engage in the incentivized behaviour. Specifically, we studied whether the financial motive to commute to work using public transport was rated as more important by participants while the incentive is in place than before the incentive is introduced and after the incentive is removed. Moreover, we tested whether engagement in the incentivized behaviour makes people realize that the behaviour has other positive consequences, that may form the basis for additional important motives to (continue to) engage in the behaviour. Specifically, we tested whether environmental, symbolic and accessibility related motives would become more important motives to commute to work using public transport during and after the intervention period, after people experienced using public transport, compared to before the incentive was introduced. We chose to measure the importance of these three additional motives, as previous research suggests that these are important motives for people to use public transport (Bamberg et al., 2007; Steg, 2005; Thøgersen, 2009). Environmental motives reflect that travelling with public transport is an environmentally friendly means of transport. Symbolic motives reflect that commuting with public transport says something about someone (Steg, 2005). Accessibility related motives reflect the impact that commuting with public transport has on the accessibility of the city, for example decreasing congestion. We, thus, examined whether the importance of these three types of motives changes during and after the three-week free public transport card, relative to before the intervention was implemented.

Finally, we tested if the three-week free public transport card crowds out, and thereby weakens, people's intrinsic motivation to commute to work using public transport.

2. Method

The present study was reviewed and approved by the Ethics Committee of the Department of Psychology at the University of Groningen.

2.1. The three-week free public transport card

The *three-week free public transport card* was introduced by a local organization, called Groningen Bereikbaar, responsible for keeping the city of Groningen accessible. The card was introduced as part of a long-term strategy to secure accessibility of the city during planned large-scale roadworks on the main highways around the city. The roadwork was planned to start in the summer of 2017. The aim of the intervention was to encourage residents who regularly commute to work in the city by car to try out public transport for free for three weeks. The

assumption was that after trying out public transport for free, at least some people would continue to use public transport, as they would become familiar with using public transport, and become more positive about it, especially later when the time of the heavy roadworks would start, in order to alleviate the amount of congestion and secure the city's accessibility.

From December 2016 onwards, participants were able to sign up to take part in the intervention. The three-week free public transport card trial was advertised with signs displayed in parking lots as well as in leaflet form in pantries in several larger organizations in Groningen. People who signed up to participate in the three-week free trial were first screened by Groningen Bereikbaar to assess whether they would be eligible to partake. In order to be eligible, people had to own a car and use it to commute to work, work in the city of Groningen, live within a 20 km radius of the city of Groningen, and live in an area that is connected with public transport services in such a way that a connection from home to work would have one or no stop overs. Those who met these inclusion criteria received a public transport card that they could then use for three weeks to commute to work for free, along with personalized advice on which public transport route they could best use to commute to work. Participants were only allowed to use the free transport card for their commute to and from work. Any other public transport trips made using the free card had to be paid back by the participants at the end of the intervention period. In January 2017, the first 100 people took part in the intervention. After that, every month, 100 new people could take part in the intervention.

2.2. Study design and procedure

The current study followed a longitudinal design with three measurement time-points. These consisted of a pre-intervention questionnaire that took place before participants had started their three-week free trial, a post-intervention questionnaire at the end of the three-week period, and a follow-up questionnaire that took place three months after the intervention period. Additionally, for those participants that granted us access, we were able to collect their travel data that was recorded on the free-public transport card that they used during the intervention period.

All participants that signed up and were eligible to participate in the three-week free public transport card trial received an invitation by email, sent from Groningen Bereikbaar, to take part in our study. The invitation email included a link to the pre-intervention questionnaire. In the pre-intervention questionnaire, participants were first informed that the aim of the research was to evaluate the free-public transport card intervention. Also, we informed participants that the study consisted of three questionnaires in total, and that participants that received the free public transport card would receive an invitation for all three questionnaires by e-mail. This information was followed by an informed consent form. Upon agreement, participants proceeded to fill out the questionnaire, including questions on intrinsic motivation to commute to work using public transport and importance ratings of financial, environmental, symbolic and accessibility related motives to commute to work with public transport. Furthermore, participants were asked about their intentions to use public transport to commute to work both during and after the three-week intervention period. Participants were then reminded that the current research consisted of three parts, and that in order to link their questionnaires to each other and gain access to their travel data during the intervention period, they would need to provide their email addresses. Participants were informed that their email address would be treated confidentially and would be deleted after data collection and analyses were completed.

At the end of the three-week intervention period, all participants that received the free travel card received an email invitation to complete the post-intervention questionnaire. Similar to the pre-intervention questionnaire, the post-intervention questionnaire included questions on intrinsic motivation to use public transport to commute to work,

importance ratings of different motives to use public transport to commute, and intention to continue to use public transport after the three-week trial period. The questionnaire ended with a reminder that the current research consisted of three parts, and that in order to link their questionnaires to each other and gain access to their travel data during the intervention period, participants would need to provide their email address.

Three months after the intervention period, participants received an email invitation to complete the follow-up questionnaire. In the follow-up questionnaire, we measured participants' intrinsic motivation to use public transport to commute to work, the importance they assigned to different motives of using public transport to commute to work, and their intention to use public transport in the foreseeable future. Again, participants were reminded that the current research consisted of three parts, and that in order to link questionnaires to each other and gain access to their travel data during the intervention period, they would need to provide their email address.

2.3. Participants

Post hoc power analyses revealed that considering an alpha = .05, power = .80 and number of repeated measures = 3, to detect a medium effect size (ES = 0.25) a sample size of 27 participants would be required.

All participants taking part in the three-week free public transport card intervention received an invitation to participate in all three measurement time points. However, not all participants completed each questionnaire, and some participants dropped out of the study, resulting in some participants only filling out the pre-intervention questionnaire, and other participants only filling out the post-intervention questionnaire or the follow-up intervention questionnaire. Moreover, some participants provided different email addresses in the different waves, so we could not link their questionnaires completed at different time points. As a consequence, we ended up with a sample of 380 people that participated in the pre-intervention questionnaire, 153 people that completed the post-intervention questionnaire, and 71 people that participated in the follow-up questionnaire. We were able to match the responses for 69 participants across the first two measurement points, and the responses of 17 participants across all three measurement time points. Information on participants' age and gender was not available to us, and thus not reported in the present research.

2.4. Measures¹

2.4.1. Intrinsic motivation to commute to work by public transport

Intrinsic motivation to commute to work by public transport was assessed with nine statements: It is fun to commute to work using public transport; I get joy from commuting to work using public transport; I like commuting to work using public transport; Commuting to work using public transport is in line with my values; Commuting to work using public transport is a sensible thing to do; Commuting to work using public transport is a good thing to do; I would feel regret if I would not commute to work using public transport; I would feel guilty if I would not commute to work using public transport. These items were adapted from the Motivations Towards the Environment Scale (MTES; Pelletier et al., 1998). Participants had to indicate to what extent these statements were in line with their motives to use public transport to commute to

¹ Measures are discussed in the order that they were presented in the questionnaire. Additional measures were included in the questionnaires that are not relevant for the purpose of the present research and therefore not reported here. These assessed participants' evaluations of the intervention and their past travel behaviour, which were included out of interest of Groningen Bereikbaar. Furthermore, there were several additional measures accessing participants' energy use behaviours in the home, included as part of another study

work (7-point scale ranging from 1 *not at all* to 7 *completely*). Across all three measurement time points, these items formed a reliable scale ($\alpha_{pre} = .87$; $\alpha_{post} = .86$; $\alpha_{follow-up} = .86$; for means and standard deviations, see Table 1).

2.4.2. Importance of financial, environmental, symbolic and accessibility related motives for using public transport

Participants were asked to report to what extent different financial, environmental, symbolic and accessibility related motives are important to them when deciding to use public transport to commute to work, on a 7-point scale ranging from 1 *very unimportant* to 7 *very important*. Three items measured the environmental motives: Limiting damage to the environment; lower greenhouse gas emissions; lower emissions of polluting particles ($\alpha_{pre} = .95$; $\alpha_{post} = .91$; $\alpha_{follow-up} = .92$). Financial motives were measured with one item: Saving money on maintenance and fuel costs of my car. Four items measured the symbolic motives: The possibility to distinguish myself from others; Shows off who I am; Fits to how I want to see myself; Says something positive about me ($\alpha_{pre} = .86$; $\alpha_{post} = .90$; $\alpha_{follow-up} = .90$). Two items measured motives related to accessibility: To increase the city's accessibility during roadworks; To decrease traffic during the roadworks ($r_{pre} = .58$; $r_{post} = .66$; $r_{follow-up} = .62$).² The items were adapted from Noppers et al. (2014). The means and standard deviations across all three time points are presented in Table 1.

2.4.3. Intention to use public transport

In the pre-intervention questionnaire, we measured participants' intention to use public transport to commute to work during the three-week trial period by asking participants to indicate to what extent they agreed with the following item: "I plan to use public transport to commute to work during the three-week free trial" (7-point scale ranging from 1 *completely disagree* to 7 *completely agree*).

In the pre- and post-intervention questionnaire, we measured intention to commute to work with public transport after the trial would end, with the following two items: "I plan to use public transport to commute to work after the three-week trial has finished" and "Even after the three-week trial has finished, I will continue to use public transport to commute to work" (7-point scale ranging from 1 *completely disagree* to 7 *completely agree*; $r_{pre} = .83$; $r_{post} = .92$).

In the follow-up questionnaire, we measured intentions to use public transport to commute to work in the future with the following two items: "I plan to commute to work using public transport in the foreseeable

Table 1

Means and standard deviations for intrinsic motivation, importance ratings and intentions to commute with public transport across three measurement time points.

	Pre-intervention	Post-intervention	3-month follow-up
Intention during three-week free trial	6.27 (1.42)	–	–
Intention after three-week free trial	3.85 (1.48)	3.55 (2.12)	3.17 (2.27)
Importance ratings:			
- Financial	4.83 (1.78)	4.91 (1.69)	4.30 (2.04)
- Environmental	4.50 (1.62)	4.46 (1.57)	4.36 (1.58)
- Symbolic	2.57 (1.33)	2.43 (1.42)	2.22 (1.41)
- Accessibility	5.25 (1.32)	5.38 (1.45)	5.11 (1.42)
Intrinsic Motivation	3.47 (1.06)	3.59 (1.14)	3.35 (1.08)

² Although the reliability of the accessibility related reasons scale was below the acceptable .7, we decided to use the scale as it was based on validated scales established in previous research. Moreover, we conducted our analyses with the single items for the scale, which yielded similar results to those reported here.

future” and “I will commute to work using public transport in the future” (7-point scale ranging from 1 *completely disagree* to 7 *completely agree*; $r = .84$).

2.4.4. Actual travel behaviour during the three-week period

The free public transport cards recorded the number of single trips participants made to and from work during the three-week period and thus gave us an accurate and objective measure of actual use of public transport during the three-week intervention period.

2.5. Analyses³

We first performed attrition analyses on all relevant variables to determine any bias due to dropout. Then, we conducted preliminary analyses by examining the means of all variables across the three measurement time-points (see Table 1). We also examined the correlations between all relevant variables across the three measurement time-points (see Supplementary Materials).

Next, we tested the effects of the three-week free public transport card on people’s intentions to use public transport to commute to work, how important they rate different motives to commute with public transport and their intrinsic motivation. Given that our data consists of repeated measures, over three time-points, we do not have independent observations for each time point. Moreover, we were not able to collect data from all participants consistently at all three time-points, consequently leaving us with a substantial amount of missing data, especially for the third measurement. To this end, we tested our hypotheses using linear mixed modelling to allow us to use the full sample in our analyses, while also accounting for the dependence of observations across time and the large amount of missing data due to drop-out. Specifically, we conducted separate linear mixed model analyses to model changes in intentions, importance ratings of the four motives and intrinsic motivation over time. For each linear mixed model analysis, we subsequently examined the mean differences across time.

3. Results

3.1. Attrition analyses

Attrition analysis showed that participants who dropped out at the post-intervention measurement did not differ from those who completed the questionnaires both at pre- and post-intervention on: intrinsic motivation, $F(1, 364) = 1.51, p = .219$; importance rating of financial motives, $F(1, 355) = 0.80, p = .373$; importance rating of environmental motives, $F(1, 356) = 0.86, p = .347$; importance rating of symbolic motives, $F(1, 356) = 0.51, p = .478$; importance rating of accessibility motives, $F(1, 356) = 0.002, p = .968$; intentions to use public transport after the three-week free incentive, $F(1, 299) = 1.89, p = .171$. Furthermore, participants who dropped out at the post-intervention measurement and at the three-month follow up did not differ from those who completed the questionnaires across all measurement time-points: intrinsic motivation, $F(1, 364) = 0.001, p = .975$; importance rating of financial motives, $F(1, 356) = 0.15, p = .698$; importance rating of environmental motives, $F(1, 355) = 0.24, p = .622$; importance rating of symbolic motives, $F(1, 356) = 2.99, p = .085$; importance rating of accessibility motives, $F(1, 356) = 2.46, p = .118$; intentions to use public transport after the three-week free incentive, $F(1, 299) = 0.03, p = .875$. These outcomes suggest that there is no evidence of systematic bias in our data due to drop out.

³ We present the correlations between intrinsic motivation, the importance ratings of financial, environmental, symbolic and accessibility related motives and intentions to use public transport after three three-week free incentive across the three measurement time-points in the Supplementary Information

3.2. Effects of the three-week free public transport card on intention to use public transport during and after the intervention period and actual public transport use during the trial

Before the intervention period, participants reported relatively strong intentions to commute to work using public transport *during* the three-week period of the intervention (see Table 1). This reflected participants’ actual travel behaviour *during* the three-week period. Specifically, on average, participants made 14 single trips to travel to and from their work with public transport during the three-week intervention period ($SD = 8.81$). This indicates that participants, on average, commuted to work using public transport approximately two days a week.

To evaluate the effects of the incentive after the intervention period ended, we compared participants’ intention to use public transport to commute to work *after* the three-week free trial period across all three measurement time points. First, inspecting the means, we find that participants reported relatively weak intentions to commute to work using public transport *after* the intervention across all three measurement time points (see Table 1). This suggests that already before trying out public transport for free for three weeks, participants anticipated to hardly intend to continue to travel with public transport *after* the free trial ended, and using public transport for free did not change this.

Next, we conducted a linear mixed model analysis to test for changes in intentions over time. Our model revealed a significant effect of time on intention to use public transport ($F(2, 263.95) = 5.42, p = .005$). Specifically, we found that intention to use public transport to commute to work after the free trial significantly decreased over time. In comparison to baseline, intention to use public transport to commute to work was significantly weaker in the post-intervention measure ($b = -.326, t(286.62) = -2.08, p = .039, 95\% \text{ CI } [-0.64, -.02]$), and remains weaker in the three-month follow up measure ($b = -.654, t(256.35) = -2.99, p = .003, 95\% \text{ CI } [-1.08, -.022]$) compared to baseline. There was no significant difference between intentions at the post-intervention and three-month follow up measure ($b = -.328, t(233.99) = -1.40, p = .164, [-0.79, 0.14]$). Means across time are visually presented in Fig. 1.⁴

3.3. Changes in importance of motives to commute to work using public transport during and after the intervention period

Our second aim was to examine whether the three-week free public

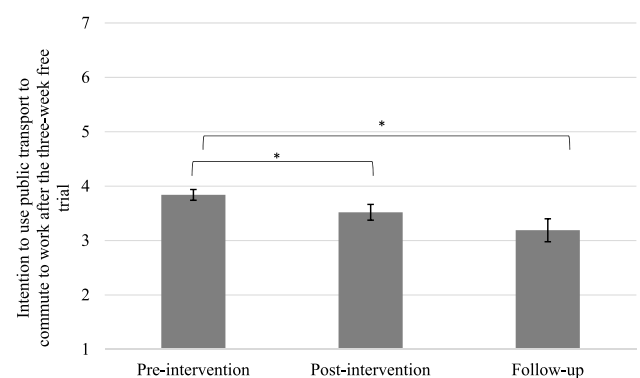


Fig. 1. Mean scores of intentions to use public transport after the three-week free trial, measured at before, after and three months after the intervention. An asterisk indicates a significant difference.

⁴ Note that the means in the linear mixed model analysis are slightly different here to the means presented in Table 1; this is the results of the linear mixed model analysis that takes observational dependence into account.

transport card may have implications for the extent to which participants rate different reasons as important for deciding whether to use public transport to commute to work. To this end, we conducted another linear mixed model analysis in which we modelled the importance ratings of financial, environmental, symbolic, and accessibility related motives over time.

We found a significant effect of time on importance ratings of the financial motives to commute to work using public transport ($F(2, 292.54) = 4.56, p = .011$). Specifically, we found that importance ratings of the financial motives were significantly lower in the follow-up measure, compared to both the pre-intervention ($b = -.556, t(287.66) = -2.59, p = .010, 95\% \text{ CI} [-0.98, -.13]$) and post-intervention measure ($b = -.696, t(257.46) = -2.98, p = .003, 95\% \text{ CI} [-1.16, -.24]$). Yet, there were no significant differences between importance ratings of financial motives in the pre-intervention measure and the post-intervention measure ($b = 0.140, t(315.18) = 0.90, p = .369, 95\% \text{ CI} [-0.17, 0.45]$).

Our analyses showed no significant changes over time in how important participants rated the environmental motives ($F(2, 221.53) = 0.648, p = .524$), symbolic motives ($F(2, 217.71) = 0.966, p = .382$), and accessibility motives ($F(2, 262.76) = 0.145, p = .145$) for their decision to commute to work using public transport.

3.4. Intrinsic motivation to commute to work during and after the intervention period

To examine whether the three-week free public transport card would crowd out intrinsic motivation to commute to work by public transport, we conducted a linear mixed model analysis in which we compared participants' intrinsic motivation to commute to work using public transport over the three measurement time points. We did not find any significant changes in participants' intrinsic motivation over time ($F(2, 218.30) = 0.563, p = .570$), meaning we did not observe a crowding out effect of intrinsic motivation over time.

4. Discussion

The present research evaluated the effectiveness of a financial incentive, namely a three-week free public transport card, in encouraging people to commute to work using public transport instead of their car both in the short-term, while the incentive was in place, and in the long-term, after the incentive was no longer in place. Specifically, we examined whether and how the three-week free public transport card influenced people's intentions to commute to work using public transport, both in the short- and in the long-term. Furthermore, we studied the underlying processes that may explain whether or not the financial incentive may (also) result in long term effects, after the incentive has been removed. Notably, we tested two lines of reasoning that have been previously proposed, but not explicitly tested, in the literature to explain why financial incentives may (or may not) result in long-term behavioural changes (Bolderdijk & Steg, 2015; Deci et al., 1999; Van Der Linden, 2015). First, we tested whether the three-week free public transport card affected the importance of financial, environmental, symbolic and accessibility related motives for using public transport to commute to work. Second, we tested whether the three-week free public transport card crowded out and thereby weakened people's intrinsic motivation to commute to work using public transport.

4.1. Effectiveness of the three-week free public transport card

Participants of the three-week free public transport card intervention were individuals that were currently primarily commuting to work by car. Our results indicate that the financial incentive was effective in encouraging public transport use when the financial incentive was in place. Participants not only indicated strong intentions to use public transport during the three-week trial, but also actually commuted to

work on average about two days a week by public transport as reflected from their travel card data. These findings are in line with previous studies that have found that financial incentives are effective tools in encouraging sustainable behaviour while they are in place (Bolderdijk et al., 2011; Bolderdijk & Steg, 2015; Kaiser et al., 2020; Thøgersen, 2009).

Yet, importantly, we found that intentions to use public transport to commute to work *after* the three-week trial were relatively weak across all three measurement time-points. Interestingly, it seemed that participants had already decided, before they participated in the three-week trial, that they would probably not continue commuting to work using public transport after the free trial ended. This was reflected by the relatively weak intentions reported by participants before they had taken part in the three-week trial (see Table 1), and was further reflected in their answers to a general open remarks question in the pre-intervention questionnaire. Many participants made the remark that they were generally positive about the free public transport card initiative, but that they were mainly taking part because it meant that they could commute for free for a few weeks. It thus may have been the case that participants were generally not planning to or open to changing their commuting behaviour. Interestingly, intentions to travel by public transport became even weaker after the three-week trial ended, and remained weak in the follow-up measure. The three-week free public transport card incentive thus appears not to be effective in encouraging sustained public transport use. Our findings even suggest that trying out public transport during the three-week trial actually weakened participants' intentions to commute to work using public transport after the intervention ended. Our findings, thus, support those of previous studies that have found that financial incentives do not lead to long-term behavioural changes, once the incentive is no longer in place (Bolderdijk et al., 2011; Bolderdijk & Steg, 2015), and are not in line with previous studies that have found financial incentives can result in long-term behaviour change, even after the incentive has been removed (Thøgersen, 2009). The following sections may provide an explanation of why this was the case.

4.2. Effects on motives to commute with public transport

Next, we examined whether the free public transport card affected participants' motives for commuting to work using public transport. For this purpose, we examined the importance of financial, environmental, symbolic and accessibility related motives in participants' decision to commute to work using public transport before, during and after the intervention period. We found that participants rated the financial motive (i.e. saving fuel and maintenance costs of their car) as a more important motive to travel by public transport before and during the three-week trial, compared to three-months after the trial had ended. Our findings suggest that the financial motive is an important factor for participants while they anticipated or received the incentive, namely that they could save money on the fuel and maintenance costs for their car during the free three-week period. However, once the incentive is no longer present, participants would have to pay to continue to commute with public transport themselves. In other words, once the incentive is no longer in place, the financially-beneficial reasons to commute to work using public transport are also no longer in place, and are thus less of an important motive in their decision of whether or not to commute using public transport (Bolderdijk et al., 2011; Bolderdijk & Steg, 2015). These findings may also explain why the incentive was not effective in the long-term, but only while in place.

In contrast, we did not find any changes in importance ratings in the environmental, symbolic and accessibility related motives. That is, participants did not rate the environmental, symbolic and accessibility related motives as more (or less) important directly after and three-months after the three-week trial had ended, relative to before they took part in the free trial. These findings lead us to conclude that trying out public transport for free may not have led participants to discover

any additional beneficial aspects of commuting to work using public transport, not resulting in rating other motives, such as the environmental, symbolic or accessibility related motives, as more important. Contrary to similar previous research that found that people acknowledged additional benefits of using public transport after trying it out for free (Thøgersen, 2009), our findings suggest that participants did not discover additional important motives to (continue) to commute to work using public transport, which may explain why participants reported even lower intentions to commute to work using public transport after the free trial had ended. It could be argued that the intervention tested in this study was not designed in such a way to target or help participants discover any additional benefits to using public transport. Moreover, a three-week intervention period may not have been enough time for participants to discover additional benefits of commuting to work using public transport. Furthermore, our results may have been different when public transport would have more advantages (e.g. when travel time would be significantly shorter). Future research could examine under what conditions financial incentives lead people to discover additional important reasons to (continue) to engage in the desired behaviour, as discovering such reasons may be key in encouraging long-term behavioural change (after the financial incentive is removed). For example, future studies could test similar interventions where financial incentives are combined with another intervention aimed at targeting other motives for engaging in the behaviour, such as targeting environmental motives by additionally providing feedback about the amount of CO₂ that people save when commuting to work using public. Furthermore, whereas commuting to work using public transport is likely more environmentally friendly and contributes to a higher accessibility of a city, it may not be a behaviour that is associated with a higher status or a particular desirable identity, thus making symbolic motives less relevant for such behaviour. Thus, future research could test whether financial incentives may lead to symbolic motives becoming more important in other pro-environmental behaviours where status and identity play a more important role, for example ownership of an electric vehicle.

4.3. Effects on intrinsic motivation to commute with public transport

Lastly, we tested whether the three-week free public transport card affected participants' intrinsic motivation to commute to work using public transport. We did not observe any changes in intrinsic motivation to commute to work using public transport before, during or after the intervention period. We, thus, find no evidence of a crowding out effect of the three-week free public transport card on intrinsic motivation to commute to work using public transport. These findings have important implications for theory, as they do not support the conclusions made in previous studies that have found evidence for motivation crowding due to financial incentives in business and educational settings (Frey, 1994; Deci et al., 1999), or that have attributed the non-significant long-term effects of financial incentives to the crowding out of intrinsic motivation (Gneezy et al., 2011; Van Der Linden, 2015). Instead, our findings suggest that financial incentives do not necessarily crowd out intrinsic motivation, and that motivation crowding out may not explain why financial incentives do not encourage long-term behavioural changes, after the financial incentive is removed. Notably, commuters in our sample did not have a strong intrinsic motivation to commute to work using public transport before the start of the intervention. Future research is needed to test if financial incentives are more likely to crowd out intrinsic motivation when intrinsic motivation is relatively strong. Yet, our sample did indicate to have a certain level of intrinsic motivation (see Table 1), so their intrinsic motivation could have been crowded out. Future research could also examine the conditions under which financial incentives are most likely to crowd out intrinsic motivation to engage in the targeted behaviour. Furthermore, it is interesting to note that we also did not find that intrinsic motivation was strengthened over time by the financial incentive (i.e., a *crowding in* effect of intrinsic motivation; Frey, 1994). Scholars have proposed that intrinsic

motivation may be fostered when financial incentives are supportive of people's intrinsic motivation to engage in the desired behaviour. Given that there is a large body of evidence suggesting that intrinsic motivation is an important predictor of pro-environmental behaviour (Pelletier et al., 1998; Steg et al., 2016; Van der Werff et al., 2013), future research could study under what conditions financial incentives might strengthen intrinsic motivation, and whether this may result in long-term behavioural changes after the financial incentive is removed.

Our results have important implications for practitioners aiming to implement temporary financial incentives as tools to encourage long-term pro-environmental behaviour. The findings in the present research suggest that financial incentives may be effective in encouraging behaviour while they are in place. However, financial incentives may also backfire once the incentive is removed, as people may not become aware of additional reasons to continue to engage in the behaviour important. Policy makers should not trust that people keep on engaging in the targeted behaviour once the incentive is removed, if they do not acknowledge additional reasons to engage in the desired behaviour.

4.4. Limitations

It is important to address several short-comings of the present study. Unfortunately, in the context of this study, it was not feasible to include a control condition to compare the effectiveness of the three-week free public transport card incentive with. As such, the findings of the present research should be interpreted with caution, as they could also be attributed to other factors not considered or controlled for in our study. Moreover, dropout across the three time points has resulted in our study being slightly underpowered to examine the long-term effects of the three-week free public transport card. Future research could try and replicate these findings of the current study in a design in a larger sample including a control condition. Furthermore, the present research studied the effectiveness of the intervention by examining changes in people's intentions to use public transport over time, as we were only able to access actual travel data during the trial due to privacy reasons. However, intentions may not always reflect actual behaviour. Thus, future studies examining the effectiveness of such incentives could replicate our findings examining actual or self-reported travel behaviour, to gain a better understanding of changes in behaviour, rather than intentions. Finally, some measures used in the current study consisted of single or few item scales, which may be slightly more prone to error and account for lack of effects found in our study. Although literature suggests that single item scales are reliable (cf. Postmes et al., 2013), future studies could replicate our study with other types of measures to test for the robustness of our findings.

4.5. Conclusions

We found that a three-week free public transport card intervention was effective in encouraging public transport use while the incentive was in place, but not effective after the intervention period ended. We extended previous research by testing the underlying processes that can explain the effectiveness of financial incentives in encouraging short-term behavioural changes (when the incentive is in place) and long-term (after the financial incentive is removed). We found that financial incentives may provide people with a temporary reason to engage in the desired behaviour, namely a temporary financial benefit, and that this may account for the effects of financial on behaviour, as people rated financial motives to use public transport as less important when the financial incentive was no longer in place. We did not find that the financial incentive affects the importance of other motives that people might have to engage in the behaviour, suggesting that the incentive did not make people acknowledge other reasons to use public transport more. Also, we did not find support for the motivation crowding hypotheses, as we did not find that intrinsic motivation to commute with

public transport weakened after the intervention period.

Declaration of competing interest

None.

Acknowledgements

We would like to thank Groningen Bereikbaar for the opportunity to conduct this study among participants of their three-week free public transport card initiative.

Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.jenvp.2021.101718>.

References

- Bamberg, S. (2006). Is a residential relocation a good opportunity to change people's travel behavior? Results from a theory-driven intervention study. *Environment and Behavior*, 38(6), 820–840.
- Bamberg, S., Hunecke, M., & Blöbaum, A. (2007). Social context, personal norms and the use of public transportation: Two field studies. *Journal of Environmental Psychology*, 27(3), 190–203.
- Bolderdijk, J., Knockaert, J., Steg, E., & Verhoef, E. (2011). Effects of pay-as-you-drive vehicle insurance on young drivers' speed choice: Results of a Dutch field experiment. *Accident Analysis & Prevention*, 43(3), 1181–1186.
- Bolderdijk, J. W., & Steg, L. (2015). Promoting sustainable consumption: The risks of using financial incentives. In *Handbook of research on sustainable consumption*. Edward Elgar Publishing.
- Bouman, T., & Steg, L. (2019). Motivating society-wide pro-environmental change. *One Earth*, 1(1), 27–30.
- Deci, E. L., Koestner, R., & Ryan, R. M. (1999). A meta-analytic review of experiments examining the effects of extrinsic rewards on intrinsic motivation. *Psychological Bulletin*, 125(6), 627.
- Everett, P. B., Hayward, S. C., & Meyers, A. W. (1974). The effects of a token reinforcement procedure on bus ridership. *Journal of Applied Behavior Analysis*, 7(1), 1–9. <https://doi.org/10.1901/jaba.1974.7-1>
- Frey, B. S. (1994). How intrinsic motivation is crowded out and in. *Rationality and Society*, 6(3), 334–352.
- Frey, B. S. (1997). From the price to the crowding effect. *Revue Suisse d'Economie Politique et de Statistique*, 133, 325–350.
- Fujii, S., & Kitamura, R. (2003). What does a one-month free bus ticket do to habitual drivers? An experimental analysis of habit and attitude change. *Transportation*, 30(1), 81–95.
- Gneezy, U., Meier, S., & Rey-Biel, P. (2011). When and why incentives (don't) work to modify behavior. *The Journal of Economic Perspectives*, 25(4), 191–210.
- Jakovcovic, A., & Steg, L. (2013). Sustainable transportation in Argentina: Values, beliefs, norms and car use reduction. *Transportation Research Part F: Traffic Psychology and Behaviour*, 20, 70–79.
- Kaiser, F. G., Henn, L., & Marschke, B. (2020). Financial rewards for long-term environmental protection. *Journal of Environmental Psychology*, Article 101411.
- Maki, A., Burns, R. J., Ha, L., & Rothman, A. J. (2016). Paying people to protect the environment: A meta-analysis of financial incentive interventions to promote proenvironmental behaviors. *Journal of Environmental Psychology*, 47, 242–255.
- IPCC, Masson-Delmotte, V. (2018). Summary for policymakers. In P. Zhai, H.-O. Pörtner, D. Roberts, J. Skea, P. R. Shukla, A. Pirani, W. Moufouma-Okia, C. Péan, R. Pidcock, S. Connors, J. B. R. Matthews, Y. Chen, X. Zhou, M. I. Gomis, E. Lonnoy, T. Maycock, M. Tignor, & T. Waterfield (Eds.), *Global Warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty* (p. 32). Geneva, Switzerland: World Meteorological Organization.
- Noppers, E. H., Keizer, K., Bolderdijk, J. W., & Steg, L. (2014). The adoption of sustainable innovations: Driven by symbolic and environmental motives. *Global Environmental Change*, 25, 52–62.
- Pelletier, L. G., Tuson, K. M., Green-Demers, I., Noels, K., & Beaton, A. M. (1998). Why are you doing things for the environment? The motivation toward the environment scale (mtes) 1. *Journal of Applied Social Psychology*, 28(5), 437–468.
- Postmes, T., Haslam, S. A., & Jans, L. (2013). A single-item measure of social identification: Reliability, validity, and utility. *British Journal of Social Psychology*, 52(4), 597–617.
- Ryan, R. M., & Deci, E. L. (2000). Intrinsic and extrinsic motivations: Classic definitions and new directions. *Contemporary Educational Psychology*, 25(1), 54–67.
- Steg, L. (2005). Car use: Lust and must. instrumental, symbolic and affective motives for car use. *Transportation Research Part A: Policy and Practice*, 39(2–3), 147–162.
- Steg, L., Lindenberg, S., & Keizer, K. (2016). Intrinsic motivation, norms and environmental behaviour: The dynamics of overarching goals. *International Review of Environmental and Resource Economics*, 9(1–2), 179–207.
- Thøgersen, J. (2009). Promoting public transport as a subscription service: Effects of a free month travel card. *Transport Policy*, 16(6), 335–343.
- Van Der Linden, S. (2015). Intrinsic motivation and pro-environmental behaviour. *Nature Climate Change*, 5(7), 612–613.
- Van der Werff, E., Steg, L., & Keizer, K. (2013). It is a moral issue: The relationship between environmental self-identity, obligation-based intrinsic motivation and pro-environmental behaviour. *Global Environmental Change*, 23(5), 1258–1265.
- Venhoeven, L., Bolderdijk, J. W., & Steg, L. (2020). Why going green feels good. *Journal of Environmental Psychology*, Article 101492. <https://doi.org/10.1016/j.jenvp.2020.101492>