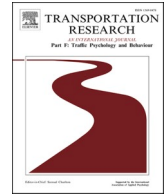


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Formation of crowdshipping habits in public transport: Leveraging anticipated positive emotions through feedback framing

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ABSTRACT

To meet global goals for emission reductions, widespread behaviour change is needed. This includes adoption of novel travel habits. Public transport-based crowdshipping represents an opportunity for linking novel travel habit formation with the challenges posed by the environmentally burdensome state of last-mile parcel deliveries. This paper investigates potential links between anticipated as well as experienced positive emotions and behaviour formation in the highly habitualised context of public transport use. The empirical basis is a two-month real-world field experiment, in which public transport passengers could carry test parcels to and from Automated Parcel Lockers placed at public transport stations and stops. A pre- and post-survey was distributed in relation to the experiment. The results show that participants who to a higher degree anticipated having positive emotions evoked by participation reported a higher degree of habit formation. Second, recipients of an environmentally framed feedback showed more conducive attitudinal and behavioural results, including habit formation and post measures for anticipated positive emotions. Third, the environmentally framed feedback further supported the habit formation effect of anticipated positive emotions. Finally, a higher degree of habit formation was found amongst participants using a smartcard compared to monthly cardholders who do not need to perform any related physical tasks when travelling by public transport. Results indicate the possibilities of supporting motivated cueing, where the reward value of performing a behaviour is conditioned onto situational cues that, with repeated participation, become associated with the (emotional) reward.

1. Introduction

The increasingly dire prospects of global warming represent a challenge that, with equally growing clarity, dictates all hands on deck: a multitude of efforts is required to decrease carbon emissions sufficiently. This includes the promotion of pro-environmental behaviours, which, according to the United Nation's Intergovernmental Panel on Climate Change, is critical to keep hope alive of limiting warming to 1.5 °C above pre-industrial levels (IPCC, 2018). In line with this, pro-environmental behaviour has received increasing academic attention. Two psychological mechanisms which have received recent attention in this domain are habits and emotions. The literature on how we can change our habits towards more environmentally friendly paths is well established and extensive (e.g. Mazar et al., 2020). Habits can be understood as learned automatic responses with specific features, such as speed and

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efficiency, but also rigidity, which thus calls for effort when behavioural changes are wanted (Wood & R unger, 2016). Contextual cues related to the environment in which a behaviour is performed can take a central role in the formation of habits (Wood & Neal, 2007). In the psychological literature, attention has also been paid to the effect of positive emotions experienced when people feel good about themselves for acting pro-environmentally, resulting in intrinsic motivation to act accordingly (e.g. Taufik et al., 2016). How anticipated positive emotions may in this way serve as a guide towards sustainable behaviour such as choosing public transport has also been explored (Carrus et al., 2008). However, the potential to leverage emotions for sustainable action has been argued to be underexplored (Brosch & Steg, 2021). At the same time, the literature exploring the potential connections between contextual cues, anticipated emotions and habit formation is scarce.

The potential for emissions reductions in changing people’s everyday routines has been illustrated for a wide range of consumption practices and daily activities, not least within transport (e.g. Grischkat et al., 2014). Most research in this field has focussed on achieving shifts from individual motorised transport to public transport or active modes (e.g. Cass & Faulconbridge, 2016). At the same time, research has been done on how the excess capacities of travellers may be utilised for freight transport, also known as crowdshipping (e.g. Le et al., 2019; Punel et al., 2018). With an expected increase in e-commerce and last-mile delivery in the next decade, there will be accompanying consequences for congestion issues, liveability in cities and climate change (Lozzi et al., 2022). It is therefore relevant to look at how integration with private people’s travel routines may represent potential to alleviate negative externalities. The term crowdshipping refers to the distribution of delivery tasks to “the crowd”, which is usually organized through an online platform. However, only a few papers have looked at the potential of public transport-based crowdshipping (e.g. Fessler et al., 2022, 2023a; Gatta et al., 2018; Serafini et al., 2018; Simoni et al., 2019). By utilizing trips that would be taken anyway, this form of crowdshipping could avoid the dedicated trips or detours that can lead private vehicle-based crowdshipping concepts to emit more instead of less compared to traditional delivery. Public transport based crowdshipping could thus alleviate the issues of the last part of goods delivery (outskirt to city center). This last stretch is by far the most inefficient part of the goods delivery chain, taking up an unproportionate part of economic and environmental costs (e.g. Macioszek, 2018; Pourrahmani & Jaller, 2021; Vanelslander et al., 2013). A few papers have evaluated the feasibility related to operational impact and sustainability (e.g. Karakikes & Nathanail, 2022; Kizil & Yildiz, 2021).

Anyone travelling by public transport would be able to sign up and crowdship, which is important, as such a concept would be dependent on utilizing as many public transport trips as possible. Regarding the potential users, or ‘crowdshippers’, the focus of existing research has been on demographic characteristics and how intention to participate may be increased by relevant service features and communication efforts (e.g. Fessler et al., 2022, 2023b; Gatta et al., 2019; Punel et al., 2018). Only limited attention has been paid, however, to how new behaviour – and eventually new habits – can be promoted in the often highly habitual situational contexts, such as daily commuting, which may pose challenging conditions for transferring intention into action. As strong habits can undermine intentions, there is often a gap between intention and behaviour which may be difficult to overcome.

The purpose of the present paper is to investigate potential links between anticipated as well as experienced positive emotions and behaviour formation in the highly habitualised context of public transport use. More specifically, the paper seeks to shed light on how novel behaviour related to mobility or sustainability, such as participation in public transport-based crowdshipping, may be facilitated by leveraging intrinsic motivations to establish environmental cues that initiate action. Furthermore, this paper investigates whether existing travel habits facilitate or hinder such contextually induced cues. This study is based on data from a two-month real-world field experiment (to our knowledge the only one of its kind), in which public transport passengers could sign up to carry empty test parcels to and from automated parcel lockers (APLs) placed at public transport stations and stops. The hypotheses presented in Section 3.2 are examined based on a pre- and post-survey distributed in relation to the experiment, as well on data from a smartphone app developed for the purpose.

2. Research background

2.1. Habits as barriers towards behaviour change

Habit has been shown to be one of the most important concepts to include in explaining mobility behaviour (Hoffmann et al., 2017; Kl ockner et al., 2003). Verplanken and Aarts’ (1999) construct of habit refers to the stability of behaviour under defined conditions. They have been defined as “cognitive structures that automatically determine future behaviour by linking specific situational cues to (chains of) behavioural patterns” (Kl ockner & Verplanken, 2018, p. 239). This happens through frequency of an action in stable contexts resulting in successful pairing of action and goal (Verplanken & Orbell, 2003). Frequency, context stability and success are thus central features of habits.

The proposed crowdshipping concept is set to operate in a domain – public transport travel – which can be highly habitualised, particularly in case of commuting (e.g. Kim et al., 2017; L egal et al., 2016). This represents a barrier to the concrete situational translation of intentions into action, as the accessibility of behavioural alternatives becomes limited when activation of certain responses in given contexts are repeated (Danner et al., 2007). Previous research has shown how – the sometimes intention-undermining – automaticity stems from developing associations between actions and performance circumstances (Neal et al., 2006). After repeated experiences linked to the same responses in the same contexts, coherent sequences of habitual responses can be activated by the environment, which provides cues that – as associative conditioning occurs – gain sufficient motivational power to launch and guide behaviour. This is due to our orientation towards prediction and control of rewards to which we are attracted, as well as punishments that we seek to avoid (Verplanken & Wood, 2006). This calls for attention to the nature of rewards and what role they can play in promoting new sustainability- and mobility-related behaviour in a highly habitualised context, where intentions are left little room.

2.2. Anticipated emotions and rewards

Previous research has shown the influence of anticipated emotions in environmentally relevant consumer choices for both high-involvement products such as cars (e.g. Rezvani et al., 2018; Schuitema et al., 2013) and low-involvement products such as groceries (Onwezen et al., 2013), as well as activities, such as the use of public transport (Carrus et al., 2008). A growing body of literature has explored the social aspect of taking sustainability-related action (e.g. Mackay et al., 2021; Masson & Fritsche, 2021; Wallis & Loy, 2021). A social component has also been applied to the positive emotions that are experienced in relation to sustainability-relevant behaviour. Identification with groups of likeminded people has been shown to yield more positive emotions as a result of conformity to the norms of the group (Christensen et al., 2004). The anticipation of positive emotions has also been shown to have relevance for the public transport-based crowdshipping concept addressed in the present paper: Examining the willingness to participate in a hypothetical crowdshipping concept, Fessler et al. (2023b) identified a joint factor including anticipated positive emotions, the social value from participation and the expected support from important others as the most important predictor of the intention to serve as a crowdshipper. In the present paper, this joint factor will be referred to as ‘anticipated social value and positive emotions’ (ASP), representing positive emotions with basis in both social and personal dimensions of sustainability-relevant self-identity.

Baumeister et al. (2007) distinguish between consciously experienced emotions and automatic affective reactions. Conscious emotions often occur after a behaviour and seldom drive it directly. In contrast, the automatic affect can occur almost immediately, allowing it to guide behaviour even at a moment’s notice, often just in the form of labelling good/bad or approach/avoid. After activation of the impulse to approach, a more precise evaluation of what to do depends on the situational affordances defined by its opportunities and constraints. These rapid evaluations may contain input from previous emotional outcomes. In this way, anticipated emotional outcomes – which guide action in accordance with the emotions people expect to be evoked – are shaped in a combination of previous emotional outcomes and current affect. Such positive emotional outcomes may entail psychological rewards for living up to ideals of ‘doing the right thing’, such as undertaking environmentally friendly behaviour (Venhoeven et al., 2013). These feelings have been shown to take the form of a ‘warm glow’, which may also encompass a social dimension of belonging or living up to social norms (Cabo, García-González, & Molpeceres-Abella, 2020; IJzerman et al., 2012; Taufik, Bolderdijk, & Steg, 2015). The question then becomes if and how the motivational potential of anticipated emotional outcomes may be deployed to induce and guide environmentally friendly behaviour in situational contexts that leave little room for conscious deliberation.

Previous research suggests that contextual cues may facilitate such processes; people are more likely to act in accordance with environmentally supportive values when these are triggered and supported by cues present in the behaviour-relevant situational context. In this way normative goals are assumed to be more salient when such values are triggered in the relevant situation (Steg et al., 2014). It is possible to imagine how cues to value-congruent behaviour may also support habit formation, when considering the process of *motivated cueing* (Wood & Neal, 2007). In the development of habit associations, the reward value of response outcomes – such as positive automatic affect – is conditioned onto contextual cues. With repeated performance, the cues become associated with the reward. In this way, contexts that become associated with positive emotional outcomes may drive habitual behaviour. This happens due to the double role of past reward conditioning: establishing context-response associations as well as injection of a motivational pull to the given response in the context. Without necessarily being conscious about it, we anticipate feeling good from performing a behaviour, therefore (re)perform it and eventually develop a habit. This relation is explored as a partial purpose of this paper – that is, assessing the role of anticipated positive emotions on habit formation (see Section 3.2 H1 and H3).

2.3. Goal frames and motivation

Goal framing theory (GFT; Lindenberg & Steg, 2007) has been applied to explain how behaviour is guided by our motivation and goal frames (e.g. Westin et al., 2020). These goal frames may vary from individual to individual and guide attention to and the relative importance of different available information. This influences what information is considered important, as well as the perceived viability of different behavioural alternatives. GFT suggests three goal frames: hedonic goal frames focus on immediately feeling good about the action, such as maximising wellbeing and excitement; gain goal frames make the individual focus on personal pros and cons such as gains/losses in money or status; and normative goal frames guide the individual towards the behaviour which is perceived as “the right thing to do”. Although varying in importance across sectors of the sharing economy, economic incentives have been shown to often be necessary prerequisites in the formation of intention to participate in sharing economic concepts (Böcker & Meelen, 2017; Hamari et al., 2016). Nonetheless, in the sphere of sustainable behaviour, it has been shown that appealing to economic self-interest (gain goal), in contrast to biospheric appeals (normative goal), is not necessarily the way to go in motivating change (Bolderdijk et al., 2013). A partial purpose of this paper is to assess how goal framings – gain vs. normative – may affect interaction, habit formation and attitudes related to the service (see Section 3.2 H2). Furthermore, another purpose is to assess how these interact with anticipated positive emotions, which may be perceived as a hedonic goal in providing a positive feeling related to participation (see Section 3.2 H3).

2.4. Habit chaining

Due to the nature and context of public transport travel, the best basis for inducing new behaviour might be given by disrupting the environmental cues that facilitate existing habitual performances, thus creating opportunities for change (Wood et al., 2005). Such cues inducing routine behaviour might, for example, be seeing that it is the usual point in time for leaving home, getting the usual on-the-go coffee or checking out the departures timetable upon arrival at the station. As such, the task of a crowdshipping solution is both

to intervene in existing cues and accompanying habits as well as to establish new ones by linking the two. As described, existing habits may pose a barrier to such new habits. However, within the sphere of technology use, it has also been shown that existing habits can be leveraged to stack on new habits (Labrecque et al., 2017). Also referred to as *chaining*, existing behavioural responses may here act as cues to trigger the novel required action and eventually habit formation (Judah et al., 2013; Pinder et al., 2018). This relates to the situated cognition perspective, in which the likelihood of a novel behaviour piggybacking on pre-existing situational cue associations increases with the extent of elements shared with existing situated conceptualisations such as time of day, actions or visual cues (Best & Papies, 2017).

A partial purpose of this present paper is therefore to assess how existing public transport travel routines affect novel habit formation. In the Danish context, this makes it relevant to consider the payment practices for travelling by public transport of season ticket holders versus users of ‘Rejsekort’, an electronic ticketing system. Danish public transport stations/stops are not closed off by ticketing facilities. The main practical difference between the two payment groups is therefore, that the former can in most cases enter the train/bus directly without having to perform any additional task, while the latter must remember to place a smartcard at card readers installed on stations or onboard busses at the start and end of a trip. The use of a Rejsekort could be a potential habit with which the new habit of bringing a parcel could be chained, as the pick-up and hand-in of the parcels occur around Rejsekort check-in and check-out, respectively (see Section 3.2 H4).

3. The present study

3.1. Field test

The practical field test of the crowdshipping solution was conducted in the autumn of 2020. An app, ‘CrowdShip’, was developed for the purpose, while 28 APLs were placed at public transport stations/stops (S-train, Metro, Bus and Train¹) in two areas of Denmark, Copenhagen and Northern Jutland. This allowed for public transport passengers to book and carry (empty) test parcels from APL to APL on their matching trips between included stations. APL placements are depicted in Fig. 1. Upon handing in the parcel, participants either received an environmentally or an economically framed feedback in the app, thanking them for participating. Participants were equally financially rewarded for each time they carried a parcel. Further details on the field test are described in the Methods section.

3.2. Hypotheses

On basis of the presented literature and field test, we formulated four hypotheses. Considering the potential for motivational pulls from anticipated positive emotions, we expected participants scoring higher on such emotions to report a higher degree of habit formation:

- H1: Participants who reported a higher degree of anticipated positive emotions in the pre-survey will report a higher degree of habit formation in the post-survey.

We expected the environmental feedback framing condition to yield better attitudinal and behavioural results than the economic feedback condition:

- H2: Compared to recipients of the economic feedback condition, participants who received the environmentally framed feedback will show more favourable results in post-measures for attitudinal variables, habit formation and the quantity of parcels carried during the experiment.

In the crowdshipping experiment, the feedback condition in the app may be considered part of the situational context that becomes associated with a reward. Following the described mechanisms for anticipated emotions and rewards, we anticipated that the feedback condition would influence the degree to which habit formation was supported by anticipated positive emotions measured as pre-survey ASP. In other words, any positive relation between ASP and habit formation found in H1 would be more pronounced for recipients of the environmental feedback framing condition, as their anticipated positive emotions were to a higher degree “redeemed” in each instance of successful participation. This means that the higher values in habit formation indicators for participants with higher ASP scores compared to those with lower ASP scores will be more pronounced for recipients of the environmental feedback condition compared to the economic feedback condition. We therefore hypothesised that:

- H3: The interaction between high ASP and the environmental feedback condition will have a more positive effect on habit formation than the other ASP/feedback interactions.

Finally, in considering the behavioural context in which H1 and H2 are embedded, we looked at existing routines’ supportive/

¹ To gain the required approvals, access to necessary locations and the facilities needed to maximise realism of the experience, the experiment was organised in collaboration with municipalities, DSB (the Danish national rail company), Metroselskabet (Metro company) and Nærboks (the APL provider, partly owned by the Danish national postal service).

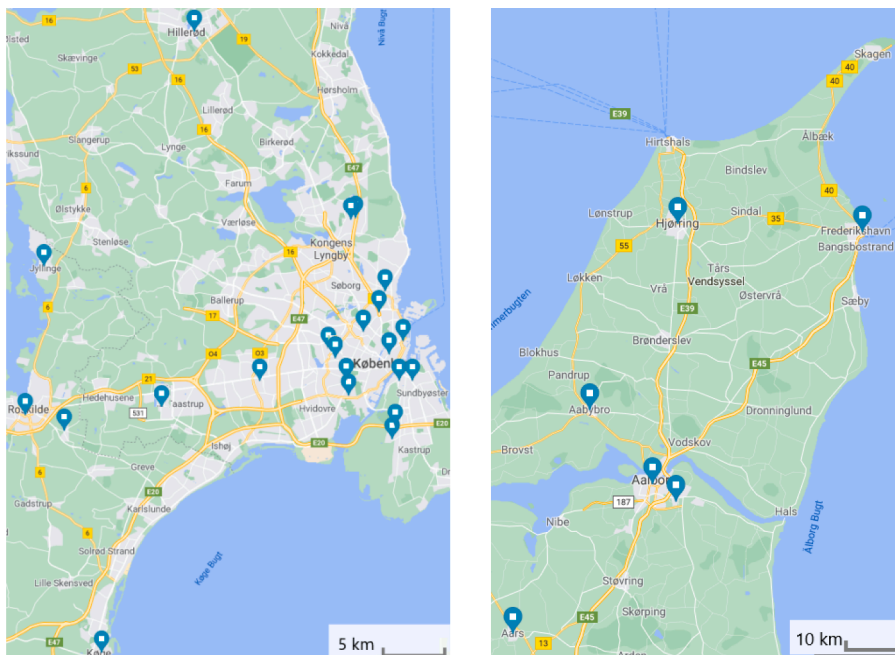


Fig. 1. APL placements in respectively the Copenhagen area and Northern Jutland. ©2022 Google.

obstructive potential for participation cues. In line with the concept of habit chaining, this led to the following hypothesis:

- H4: Participants who actively must ‘check in’ and ‘check out’ when travelling by public transport will report a higher degree of habit formation compared to monthly travel card holders.

4. Method

The experience of the concept was measured through (a) a pre-survey, (b) the practical test data and (c) a post-survey. The latter was split into two separate surveys: one for those who took part in the practical test by carrying the minimum of two parcels and another for pre-survey respondents who did not engage in the crowdshipping activity.

4.1. Practical test

The practical test was launched in early September 2020 and originally scheduled to last throughout the month. However, a national COVID19-lockdown² hit on September 18th. The test period was therefore extended to last through October to compensate for the vastly diminished number of public transport trips taken due to being sent home from work, among other causes. Through the app, participants could 1) book a test parcel with a matching route, by entering departure and destination station/stop³; 2) open the APL at their departure point through Bluetooth; and 3) likewise hand in the parcel at their destination’s APL (depicted in, respectively, screen 1, 2 and 3 of Fig. 2).

When the APL was closed at parcel hand-in, a “Thank you”-animation screen was shown in the app (see Fig. 3). Two such feedback screens were deployed to assess potential differences in goal framing: appealing to the social/environmental vs. monetary value of participation. Participants were randomly selected to receive either one for the entire duration of their participation. Half received the environmentally framed feedback: ‘Hand-in completed! Thank you for helping in making the city greener’, along with a green-coloured animation. The other half received the economically framed feedback: ‘Hand-in completed! 10 kr. transferred to your gift certificate’ along with an animation of a spinning coin. Only this framing varied: the two groups were equally compensated. The process of booking a parcel and opening/closing the locker to pick it up could be completed in less than 20 seconds.

Participants received a basic compensation of 50 Danish kroner (€6.7) in the form of a gift certificate for completing a pre-survey, carrying a parcel on two trips and completing a post-survey. This rewarded participants for their time spent on the two surveys and

² During the lockdown, travel via public transport was still possible, but work from home was strongly encouraged.

³ Both being amongst the 28 included stations/stops.

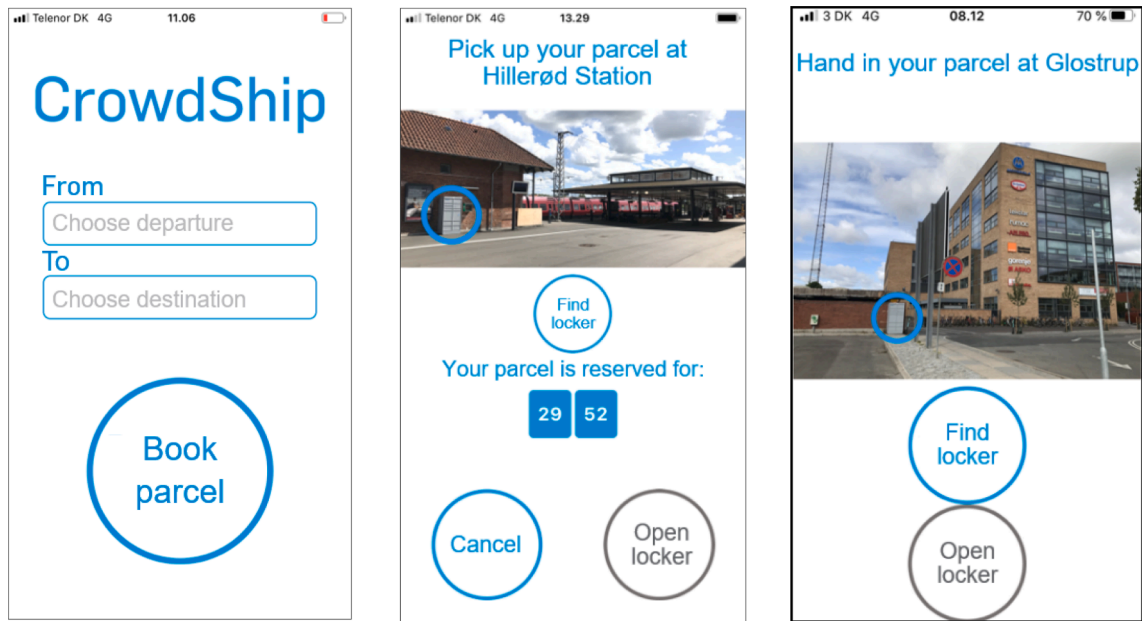


Fig. 2. App Screenshots: Screen 1,2 and 3.

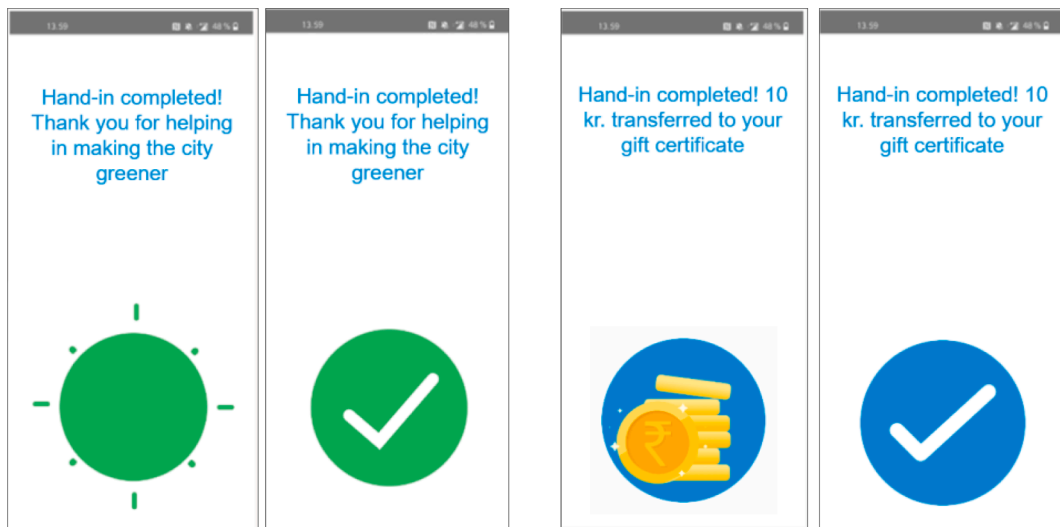


Fig. 3. The Two Feedback Framings.

installing the CrowdShip app. To imitate the basic financial incentives of a realised concept, participants then received 10 kr. (€1.3) added to their gift certificate for each additional trip. The participants could maximally be compensated with 100 kr. (=7 trips).⁴ Parcels were of relatively small size (19 × 12 × 4 cm) and only weighed a few grams (the weight of their own cardboard material).

The smartphone app for the experiment was developed for both iOS (iPhone) and Android. It gathered information about each participant’s interaction with the service: each time a parcel was carried (including timestamp and departure/destination point) as well as to which feedback framing group (environmental or economic) the given participant had been assigned.

⁴ In a realised solution, crowdshippers should receive the remuneration as credit for the transit system. Also, it should be possible to earn more credit by carrying multiple parcels.

4.2. Procedure and participants

Participants were recruited through sign-up links distributed on social media from September 1st 2020. The experiment was also mentioned in various national and local tv, radio and online news outlets, which helped to promote it more broadly. After completing the pre-survey, participants received an email with download links and installation guides for the app, as well as a guide for participation. During most of the experiment period, a weekly reminder email was sent to all pre-survey respondents who had not yet carried a parcel. Frequency of reminders increased over the last two weeks, with daily reminders during the last four days. Links to the post-survey were sent to all respondents who had completed the pre-survey immediately after the experiment period. Separate surveys were sent to those who participated and those who did not.⁵

The pre-survey was completed by 454 respondents (64% women, 34% men) aged 16–73 years ($M = 29.07$; $SD = 11.45$). Of these, 157 (35%) also took part in the practical test, while 144 (92%) of those who did so also completed the post-survey (60% women, 38% men). Sample characteristics for these 144 participants are presented in Table 1.

The vast majority either paid most of their public transport trips through a monthly pre-paid card (47%) or by Rejsekort (47%). Participants in the practical test covered the same age span of 16–73 years ($M = 29.66$; $SD = 10.88$). Of the pre-survey respondents who did not participate in the practical test, 145 completed the post survey for non-participants. During the experiment, just below 900 trips with a test parcel were made. The average number of parcels carried per participant was 5.5 ($SD = 5.04$).⁶ Upon request, the regional scientific ethics committee in the Capital Region of Denmark informed us that ethical approval was not necessary for the study.

4.3. Survey respondents not taking part in the practical test

The overall most frequently indicated reason for not taking part in the practical test was being sent home due to COVID-19 and consequently not travelling as usual. In the survey for non-participants, this was given as the main reason by 22% of respondents who installed the app, and 32% of those who did not install it. Further, 39% and 29% of installers/non-installers, respectively, selected “Other” as the main reason, for which many elaborated that their non-participation was due to COVID-19 in an accompanying text entry. Amongst app-installers, the main reason for not participating was forgetting it when they travelled by public transport, although they had intended to do so (27%). No attitudinal or demographic differences were found when comparing respondents who downloaded the app, but forgot to participate and those who did remember (independent t -tests, $p > .10$). Participants and non-participants did not differ significantly in any attitudinal variables, including intention to participate in a realised concept ($p > .10$).

4.4. Survey content

To assess the effect of interacting with the crowdshipping concept in practice, the pre- and post-surveys included a joint set of psychological items intended to cover factors inspired by an extended version of the theory of planned behaviour (Ajzen, 1991). The pre-survey additionally covered information on the respondents’ public transit use, such as most used routes, frequency, mode of payment and travel satisfaction, as well as the following sociodemographic variables: postal code of residence, age, gender, household composition, income, employment status, work hour flexibility and education. All relevant pre-survey items were included in a principal component analysis (PCA; see Table 2). In addition to the joint item set, the post-survey included specific questions on the experience with the crowdshipping concept. The following section describes the items relevant for the purposes of this paper. All items were answered on five-point agreement scales, except for the items in the Satisfaction with Travel Scale. For more details on the content of the two surveys, see Fessler et al. (2023a).

Habit of public transport use was measured through a *context stability* and a *habit automation* construct with three items each. The items on context stability measured perceived stability of purpose, time and route to/through station in the context of the journey specified by the participant as their most frequent (adapted from Friedrichsmeier et al., 2013). Habit automation was measured with two items on journey automaticity adapted from the Self Report Habit Index (SRHI; Verplanken & Orbell, 2003). In addition, one item was created to measure the degree to which the participant leaves for the station/stop to take the first coming departure without checking timetables in advance. This new item loaded on the same factor as the two aforementioned in the PCA. The Cronbach’s alpha of mean scales created from the two groups of items was 0.710 and 0.615, respectively.

Satisfaction with travel (STS) was measured with seven items. This was done through two STS sub-scales, time and comfort. These entailed three items measuring, respectively, whether the participant in relation to their most frequent journey felt stressed, hurried and worried about arriving on time, and three items on the ease, functioning and comfort of the trip (Ettema et al., 2011). Additionally, one item was created to measure the degree to which the participant feels safe on the trip. Cronbach’s alpha was 0.907.

Concept attitude measured the perceived value of participation and the perceived fairness of this in comparison to the imagined gains of a non-specified crowdshipping company imitated in the test (e.g. Morton et al., 2021). It also included items related to symbolic motives (status) and potential feelings of embarrassment in receiving compensation. The construct was measured with four items. Cronbach’s alpha was 0.665.

⁵ Participation was automatically registered through the app. The only content of the survey for non-participants was their reasons for not participating.

⁶ Only including respondents of the post-survey.

Table 1
Sample characteristics.

| Variables | Participants |
|------------------------------|--------------|
| <i>N</i> | 144 |
| <i>Gender</i> | |
| Female | 60.4 % |
| Male | 38.2 % |
| Other/Do not wish to answer | 1.4 % |
| <i>Age</i> | |
| 25 and below | 52.1 % |
| 26 – 39 years | 34.0 % |
| 40–64 years | 13.2 % |
| 65 years and above | 0.7 % |
| <i>Employment status</i> | |
| Working | 32.6 % |
| Student | 52.8 % |
| Non-working | 8.3 % |
| Retired | 4.2 % |
| <i>Education level</i> | |
| Low | 43.1 % |
| Medium | 31.3 % |
| High | 22.9 % |
| <i>Income</i> | |
| Below median | 63.7 % |
| Median | 16.1 % |
| Above median | 20.2 % |
| <i>Geography</i> | |
| Copenhagen Outskirts | 50.7 % |
| Copenhagen Central Districts | 39.6 % |
| Northern Jutland | 4.7 % |

Table 2
Principal Component Analysis (Pre-survey items).

| Principal Component Analysis (Pre-survey) Item | Context stability | Habit automaticity | STS | ASP | Concept attitude |
|--|-------------------|--------------------|--------------|--------------|------------------|
| I always make this journey more or less at the same time of the day. | 0.785 | 0.043 | 0.100 | -0.007 | 0.037 |
| The purpose of this journey is always the same. | 0.774 | 0.090 | -0.029 | -0.012 | 0.001 |
| The journey is a (daily, weekly, monthly) routine for me. | 0.766 | 0.199 | 0.062 | 0.136 | -0.046 |
| I just go out the door and take the first departure, without checking the timetable in advance. | -0.081 | 0.764 | 0.015 | -0.030 | 0.099 |
| I make the journey without having to think what to do. | 0.283 | 0.729 | 0.059 | -0.076 | -0.027 |
| I make the journey automatically. | 0.403 | 0.675 | 0.120 | 0.015 | -0.032 |
| Travel is uncomfortable – Travel is comfortable | 0.045 | -0.057 | 0.801 | 0.148 | 0.036 |
| Travel is laborious – Travel is uncomplicated | -0.021 | 0.098 | 0.759 | 0.047 | -0.057 |
| Travel works poorly – Travel works well | 0.042 | 0.038 | 0.841 | 0.064 | -0.028 |
| I feel safe – I feel unsafe | 0.046 | 0.030 | 0.777 | 0.005 | -0.021 |
| I feel stressed – I feel calm | 0.041 | -0.035 | 0.843 | 0.017 | -0.019 |
| I feel hurried – I feel relaxed | 0.034 | 0.015 | 0.826 | 0.035 | 0.016 |
| I feel worried about arriving late – I feel confident about arriving on time | 0.035 | 0.102 | 0.732 | 0.063 | -0.021 |
| Many of my friends would participate in the concept. | 0.053 | -0.180 | 0.079 | 0.521 | -0.050 |
| I would feel community spirit with the other users. | 0.082 | -0.099 | 0.017 | 0.702 | 0.012 |
| I would feel part of a positive movement. | -0.029 | 0.101 | -0.021 | 0.715 | -0.176 |
| I would feel proud to do my small part in making the city greener | 0.014 | 0.082 | 0.081 | 0.747 | -0.241 |
| For me, it would give value to participate. | -0.027 | 0.027 | 0.140 | 0.697 | -0.191 |
| It would be a bit embarrassing to meet someone I know, while I was picking up/delivering a parcel. | 0.011 | -0.055 | 0.029 | -0.091 | 0.731 |
| I do not want to be associated with parcel couriers. | 0.068 | 0.000 | 0.035 | -0.030 | 0.711 |
| Participation is only for ‘discount hunters’. | -0.020 | 0.074 | -0.096 | -0.218 | 0.709 |
| The concept would unfairly take advantage of me as a form of cheap labour. | -0.087 | 0.061 | -0.049 | -0.251 | 0.602 |
| Cronbach’s alpha (Pre-survey) | 0.710 | 0.615 | 0.907 | 0.716 | 0.665 |

Anticipated social value and positive emotions (ASP) consisted of five items that formed a common factor measuring positive feelings around participation. The items first covered social aspects of participation that included subjective norms (Ajzen, 1991) and relatedness (e.g. Schikofsky, Dannewald & Kowald, 2020). This measured the degree to which participants imagined their social circle participating, as well as potential positive feelings of being part of a movement or community as a result of participation. Second, they covered the construct of warm glow (e.g. Venhoeven, Bolderdijk & Steg, 2013), which assessed the imagined potential of participation to elicit positive emotions as a result of contributing towards societal needs and environmental protection. Cronbach’s alpha was

0.716.

In addition to the theoretically based factors, a mean scale for *habit formation* was created from four items loading on the same factor in a separate PCA for post-survey items. The construct measured the perceived extent of habit formation during the test and expected habit of participation in a realised concept (see Fig. 4). Cronbach’s alpha was 0.725.

4.5. Analysis

A combined dataset encompassing pre-survey, Crowdship app and post-survey data was analysed. We first provide descriptive statistics (percentages and means) as well as Pearson’s correlations to examine linear relations between selected variables; to test Hypothesis 1, we examine the correlation between ASP and habit formation. Subsequently, to test Hypothesis 2, an independent samples *t*-test is conducted to assess post-measure differences in attitudinal and behavioural variables between the two feedback groups. Finally, to test Hypotheses 3 and 4, multiple linear regression is performed with habit formation as dependent variable. Included independent variables are habit automaticity, context stability, STS, existing transport habits (payment mode) and interactions between ASP and feedback conditions.

5. Results

Fig. 4 presents the level of agreement for the four items included in the habit formation variable. The first two items referring to experiences during the field test received lower levels of agreement than the last two items referring to expectations about future habit formation.

The aggregated habit formation variable consisting of the four items depicted in Fig. 4 had a mean score of 3.42 and standard deviation of 0.71.

A small correlation was found between habit formation and the number of parcels carried during the experiment, $r(141) = 0.260, p = .002$, thus people with higher self-reported habit formation, carried more parcels.

A moderate positive correlation was found between the degree of anticipated positive emotions in the pre-survey (ASP) and habit formation in the post survey, $r(141) = 0.327, p < .001$, which confirmed H1.

To assess potential differences between the environmentally focused feedback group and the economically focused feedback group, independent samples *t*-tests were performed (see Table 3). The two groups did not differ significantly in the pre-survey results, so differences between groups in the post-survey results can most likely be attributed to the different feedback conditions.

In the independent samples *t*-test, we found that recipients of the environmentally framed response brought along parcels on significantly more of their public transport trips between stations/stops included in the test compared to the recipients of the economically framed response. Where the economic feedback group on average brought along parcels on 34% of such trips, the environmental response group carried parcels on 43%. They also scored higher on habit formation. Additionally, in post-survey measures, the environmental response group scored significantly higher in ASP and reported a significantly lower degree of concept attitude reservations. We thereby see significantly better results for a range of both attitudinal and behavioural variables for those receiving the social/environmental feedback condition, confirming H2. Scores for ASP and concept attitude are generally seen to go ‘the wrong way’ from pre- to post survey. This could be ascribed to participants to a higher degree bringing the many situational constraints into consideration for their post-evaluations of intention to participate in a realised concept (Fessler et al., 2023a).

We performed a multiple linear regression with habit formation as the dependent variable to test the assumed interaction between ASP and the feedback-condition (H3) and the influence of the payment mode (H4). We additionally included the number of trips on which a parcel was carried, the two public transport habit constructs and satisfaction with travel as control variables. The model explains 23.6 % of the variance. As expected, a higher degree of pre-survey ASP in combination with the environmental response had a

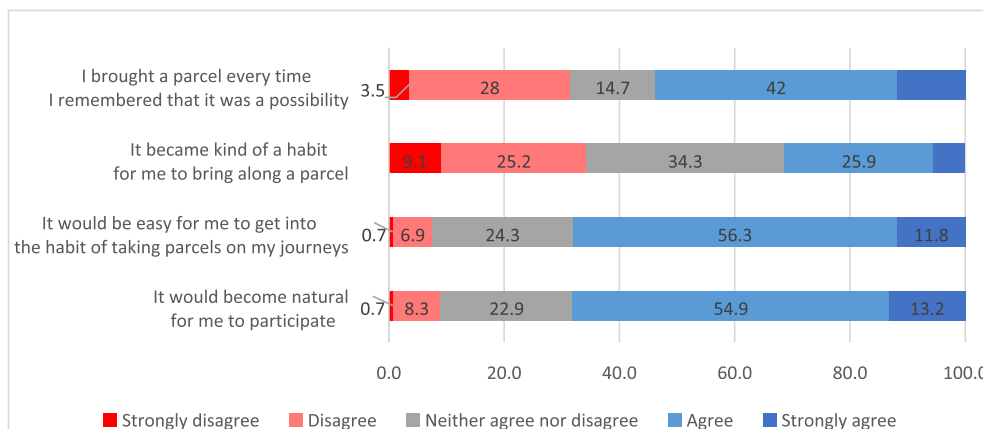


Fig. 4. Habit Formation items (Percentage of agreement).

Table 3
Independent Samples T-test: Differences Between Feedback Framing Groups.

| T-test results | Pre survey scores | | | | Post survey scores | | | | Independent samples <i>t</i> -tests | | | | | | |
|------------------------|------------------------------|-----------|--------------------------|-----------|------------------------------|-----------|--------------------------|-----------|-------------------------------------|-----------------|-----------------|-------|------------------|-----------------|------------------|
| | Environment (<i>N</i> = 66) | | Economy (<i>N</i> = 78) | | Environment (<i>N</i> = 66) | | Economy (<i>N</i> = 78) | | <i>p</i> (pre) | <i>p</i> (post) | 95% CI of diff. | | <i>df</i> (post) | <i>t</i> (post) | Cohen's <i>d</i> |
| | <i>M</i> | <i>SD</i> | <i>M</i> | <i>SD</i> | <i>M</i> | <i>SD</i> | <i>M</i> | <i>SD</i> | | | Lower | Upper | | | |
| ASP | 3.89 | 0.46 | 3.74 | 0.57 | 3.71 | 0.54 | 3.47 | 0.61 | 0.102 | 0.016 | 0.04 | 0.43 | 141 | 2.43 | 0.40 |
| Concept attitude | 1.97 | 0.58 | 2.07 | 0.65 | 2.08 | 0.56 | 2.3 | 0.66 | 0.363 | 0.034 | −0.42 | −0.02 | 141 | −2.14 | −0.36 |
| Habit formation | — | — | — | — | 3.58 | 0.63 | 3.29 | 0.74 | — | 0.015 | 0.06 | 0.52 | 141 | 2.47 | 0.41 |
| % of trips with parcel | — | — | — | — | 42.54 | 27.80 | 33.8 | 24.61 | — | 0.048 | 0.08 | 17.41 | 141 | 1.99 | 0.36 |

statistically significant effect, while the other three combinations of ASP and feedback conditions were not significant. The interaction between high ASP and the environmental feedback condition was thus found to have a more positive effect on habit formation than the other ASP/feedback interactions, which confirmed H3 (see Table 4). We also found a significant positive effect of the Rejsekort payment mode. Participants who actively ‘check in’ and ‘check out’ when travelling by public transport reported a higher degree of habit formation compared to monthly travel card holders, which confirmed H4.

We found a significant positive effect of trips with parcel⁷ and context stability and a negative effect of habit automaticity. Satisfaction with travel had no statistically significant effect.

6. Discussion and conclusions

This paper investigated the links between anticipated as well as experienced positive emotions and habit formation in the already highly habituated context of public transport use. Following this, it investigated the potential to leverage intrinsic motivations to establish contextual cues to initiate action through goal framings. Further, whether different existing travel routines (actively checking in/out or not) facilitate or hinder such habit formation was also investigated. This was done based on data from a two-month real-world field experiment in which public transport passengers could bring along test parcels to and from APLs placed at public transport stations and stops.

We found that the construct ‘anticipated social value and positive emotions’, ASP, is significantly positively related to habit formation; those who to a higher degree anticipated having positive feelings evoked in relation to participation reported a higher degree of habit formation. These results illustrate the facilitating potential of anticipated positive emotions in habit formation. A higher degree of ASP may influence the automatic affect that can occur almost immediately in the participant’s evaluation of the behaviour, guiding him/her to pursue it. In this interpretation the (emotional) reward value of participating becomes conditioned onto contextual cues, establishing motivated cueing (Wood & Neal, 2007). An alternative explanation could be that anticipated positive emotions led directly to participating more often and thus developing stronger habits. To test this, another linear regression was performed with habit formation as the dependent variable, and independent variables that included the number of trips taken with a parcel and pre-survey ASP as a separate continuous variable (see Appendix). Here, ASP was also highly significant, which supports our first interpretation.

As hypothesised, recipients of the environmentally framed feedback showed more conducive results for ASP, concept attitude, habit formation and number of trips taken with a parcel during the experiment in comparison to the economically framed feedback. This suggests that the motivational potential of environmentally focused goal framings may also be applied to increase crowdshipping participation. The more positive results amongst recipients of the environmental framing mirror the results of prior research on emotional versus monetary motives influencing environmental behaviour: People are more likely to engage in pro-environmental action if they anticipate feeling good when performing it, thus they do not take only instrumental costs and benefits into consideration (e.g. Carrus et al., 2008; Taufik et al., 2016).

Also as hypothesised, we found that giving an environmentally framed feedback further supported the habit formation effect of ASP; participants with high ASP who received the environmental feedback were the only ASP/feedback group for which a significant effect was seen on habit formation. These results indicate that the emotional reward value may become conditioned onto situational contexts to establish behavioural cues. Results are in line with Bamberg’s (2013) stage model of self-regulated behavioural change, consisting of a predecision, preaction, action, and postaction stage. In the model’s predecision stage, positive emotions anticipated with goal progress support the creation of ‘goal intention’ as an element in the formation of a new behaviour. The anticipated positive emotions included in the ASP factor could be interpreted in this light as being to a higher degree redeemed for environmental feedback recipients, which is further underlined by the regression results: the positive relation between ASP and habit formation was further pronounced for those with higher ASP who received the environmental feedback. In this interpretation, the norms and values which they have successfully lived up to (normative goals) are made salient through the in-app feedback. The experienced positive emotions related to this support the new behaviour – and eventually habit formation (Carver & Scheier, 1990). In contrast, the activation of financial symbols, has previously been shown to activate egoistic values (e.g. Lindenberg, 2018). Such appeal to economic self-interest has been shown to undermine intrinsic moral motives, and thus in some instances is less suited to support behaviour change within the environmental domain (Bolderdijk et al., 2013). The results show potential implications for the crowdshipping concept and related mobility- or sustainability-related solutions, as well as for research on habits. They indicate that a crowdshipping solution might increase chances of success by catering to altruistically and socially oriented values, by framing participation environmentally towards users rather than focusing on economic incentives in its design and communication.

Finally, as hypothesised, we found that public transport passengers using the Rejsekort – paying their trips by physically checking in and out by placed cards readers – reported a significantly higher degree of habit formation. The result indicates that users of Rejsekort have been able to benefit from existing routines, related to the cognitive and practical task of physically checking in with the smartcard. This suggests that promotion of novel transport- or sustainability-related behaviour may benefit from chaining effects: new habits may be supported by chaining to related established habits. At the same time, the results point to the relevance of an intervention – such as push notifications – to disrupt existing automaticity-imprinted travel behaviour in general and the routines of pre-

⁷ An equivalent regression was performed substituting a variable that took the amount of travel with public transport during the experiment period into account for the trips variable, as included in Table 3. It thus showed the percentage of trips in which a parcel was carried rather than the raw number of times a parcel was carried. The model yielded similar results, with the same variables showing (in)significant effects.

Table 4
Multiple Linear Regression Explaining Habit Formation.

| Predictors | β | 95% CI β | <i>p</i> |
|-----------------------------------|---------|----------------|----------|
| Constant | | 1.434–3.078 | <0.001 |
| Trips with parcel | 0.279 | 0.017–0.062 | <0.001 |
| Habit automaticity | −0.176 | −0.28– −0.009 | 0.036 |
| Context stability | 0.207 | 0.024– 0.306 | 0.022 |
| Satisfaction with travel | 0.157 | −0.004–0.264 | 0.058 |
| Payment mode Rejskort | 0.215 | 0.083–0.545 | 0.008 |
| High ASP – Environmental feedback | 0.280 | 0.152–0.724 | 0.003 |
| High ASP – Economic feedback | 0.111 | −0.115–0.48 | 0.227 |
| Low ASP – Environmental feedback | 0.074 | −0.182–0.456 | 0.397 |

Note. All VIFs were smaller than 2, indicating that there is no multicollinearity among predictors.

paid monthly cardholders in particular.

In the confirmation of the four hypotheses, three central features of habit were illustrated. Frequency, context stability and success were all found to significantly influence habit formation. Frequency, in the form of trips taken with a parcel during the experiment, and context stability of public transport travel habits were both found to have significant effects on habit formation. The understanding of success is here expanded upon to include the experience of positive emotions evoked from living up to one's own and others' ideals of 'doing good' as well as from being part of a social group sharing these values. The effect of anticipating these emotions was seen to be significantly correlated to habit formation, and it was seen that if the anticipations were to a higher degree redeemed by the feedback at parcel hand-in, the success of this completed participation to a significantly higher degree contributed to habit formation. The three features of habit are seen to support motivated cueing, where the reward value of the response outcome (the redemption of ASP resulting in positive affect) is conditioned onto the situational participation cues that, with repeated participation, become associated with the emotional reward. The potential barrier of habit automaticity was also illustrated in the results by the significant negative effect on habit formation.

In addition to informing implementation of more or less related concepts, these results may be applied to add an emotional dimension to future studies of motivated cueing. More specifically, future studies may benefit from expanding the understanding of success to encompass anticipated positive emotions as an element in habit formation in general and with a role in cueing a behaviour in particular. Furthermore, the empirical support for the concept of habit chaining through related physical tasks may inform intervention measures in future studies on behavioural change in highly habitualised travel contexts.

7. Limitations and future research directions

There are limitations to consider when interpreting the results. First, the relatively brief period in which the experiment took place was shorter than what is often considered necessary to form a new habit (Lally et al., 2010), especially when considering the COVID-19 lockdown, which was announced shortly after the launch of the experiment. The role of the COVID-19 situation on habits is unknown, with some prior research indicating potential conducive conditions for novel habits as a result of disrupted habitual behaviour (Wood et al., 2005), and other research showing the opposite due to the cognitive demands of travelling by public transport during the pandemic, as divergence from habits is hard under conditions of cognitive load (Przybylowski, Stelmak and Suchanek, 2021). The lockdown also meant that many did not travel as frequently as usual. To compensate for this, the habit formation construct was composed of both retrospective and prospective items. Although the construct was empirically formed and had acceptable internal consistency, this should be kept in mind when interpreting the results.

Future research under normal conditions and over a longer test period should be conducted to confirm the findings. The relatively small sample size resulting from the lockdown and also entails limited generalizability and that the work should be regarded as exploratory.

Other potential limitations related to the constructs include the scope of the ASP-construct, which was intended to measure the anticipated positive emotions stemming from both social value, feelings of community and living up to own ideals. Although the construct has acceptable internal consistency, the range of sources for these anticipated positive emotions is broad. This could complicate the interpretation of related results. The constructs of context stability, habit automation and concept attitude have Cronbach's alphas ranging from 0.62 to 0.71. For those with reliability scores in the lower end, this should be considered as a limitation.

For findings related to the two feedback framing conditions, the addition of a control group without any feedback would have strengthened the basis for interpretation of results but was omitted due to the limited sample size. While a hypothetical experiment would be better suited to test various feedback conditions under controlled conditions, the field experiment approach was chosen due to the higher validity of the associated data.

Although interpretations of reverse causal effects are prevented by examining the effects of variables of the pre-survey and feedback conditions on a post-survey variable, while controlling for other relevant variables, it can still be the case that omitted variables play a role.

Another limitation is related to the sample of participants, who were all volunteers and probably had more positive environmental norms than average public transport users. Thus, results cannot be generalised to all public transport users. However, as high ASP has

previously been identified a relevant factor of the intention to participate in the service (Fessler et al., 2023b), we can assume that the sample to some degree reflects attitudes of people who would participate in a realised crowdshipping system.

To get a more detailed understanding of when and how the opportunity to bring a parcel was cued and acted upon, participants could have been prompted to reflect on their participation immediately after hand-in. Although possible within the experiment's technical setup, we did not choose this option, to avoid that the 'burden' of evaluation could become associated and/or confused with the actual participation. This might 1) demotivate participation and 2) affect post-survey evaluations. Future studies could advantageously apply research designs that allow for more detailed descriptions of behavioural cueing.

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CRediT authorship contribution statement

Andreas Fessler: Conceptualization, Methodology, Formal analysis, Data curation, Writing – original draft, Funding acquisition. **Christian A. Klöckner:** Writing – review & editing, Methodology. **Sonja Hausteine:** Supervision, Methodology, Writing – review & editing, Funding acquisition.

Declaration of Competing Interest

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Data availability

The authors do not have permission to share data.

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