

# Response Latency reveals Participants' Motivations to Join a Behavioural Change Program

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## SHORT SUMMARY

What motivates people to change their travel behaviour? In voluntary behavioural change programs, this question is typically answered by asking participants why they have joined the program. The frequency of a motivation's citation is then considered a proxy for its importance. In this study, we propose an additional 'proxy' criterion to assess the psychological salience of the stated reasons, namely response latency (the time between the start of the advertising of the program and the moment of registration). Considering that the program is marketed to everyone at the same point in time, we argue that response latency can be regarded as an inverse measure of the degree of motivation to change one's behaviour. This allows us to identify stronger and weaker motivators. We use this idea to identify the importance of particular motivations to join a behavioural change program at TU Delft.

**Keywords:** voluntary behavioural change, motivation, response latency

## 1. INTRODUCTION

Transportation researchers have a strong interest in discovering which psychological motivations lead people to adopt travel behaviours that are desirable from a societal perspective. Many voluntary behavioural change programs have been set up for travellers' to change to more sustainable or healthy travel modes (e.g. de Kruijf et al., 2018; MacArthur et al., 2017; Thøgersen, 2009). An often-overlooked element in such studies, and in travel behaviour research more generally, is the motivation of a participant to join a behavioural change program in the first place, whereas this is a very important factor in understanding potential for change in travel behaviour in the long-term (Fyhri and Fearnley, 2015).

A straightforward, but as we will argue incomplete, approach to discover participants' motivations to join a behavioural change program is to ask those people why they have applied and then identify the most often mentioned motivations as the most important ones (e.g. Plazier et al., 2017). This is typically done by letting participants select one or multiple answers from a pre-defined list of reasons. However, by simply 'counting motivations' and studying their (relative) frequency, the analyst implicitly assumes that every cited reason counts equally.

Building on behavioural intuitions and insights from the behavioural sciences, we argue in this study that this approach of counting motivations offers an incomplete and potentially biased picture of which motivations are important. Also, we propose an additional, novel 'proxy' criterion to assess the psychological salience of stated motivations, namely the response latency, i.e., the time between advertisement of the program and the participant's decision to join the program and cite a particular motivation for doing so. As a crucial corollary, we posit that the reasons cited by those early adopters are more important motivators than those cited by laggards. Using these behavioural intuitions which build on past empirical work in the behavioural sciences, we

suggest that the relative importance of motivations to join a travel behaviour change program can be uncovered by means of statistically relating a motivation to the response latency of the traveller that cites this motivation.

We perform our analyses in the context of a voluntary behavioural change program among employees and students of TU Delft.

## **2. WHY RESPONSE LATENCY CAN BE USED TO IDENTIFY RELATIVE IMPORTANCE OF MOTIVATIONS**

In this section, a series of behavioural intuitions are discussed to gradually build towards our core argument: that motivations that are cited by early adopters are likely to be more important (to those early adopters) than motivations that are cited by late adopters are (to those late adopters).

The first intuition is that an important problem experienced by a person (traveller) is relatively likely to be on top of her or his mind, compared with an unimportant problem. In other words, the salience of a problem and the frequency with which the problem surfaces in a traveller's thoughts, is positively related to its perceived importance (by the traveller).

The second intuition is that an advertisement for a (travel) behavioural change program observed by a traveller will more likely lead to a behavioural intention to join that program, if the traveller, *at the moment she or he observes the advertisement*, believes that the program offers a (partial) solution to a pressing problem that she or he *currently* experiences.

Combining these two intuitions, we may conclude that relatively important problems trigger a relatively quick reaction to an advertisement for a potential solution for those problems, compared to relatively unimportant problems, simply because the latter ones are less likely to be top-of-mind at a particular moment a traveller observes the advertisement. As such, it makes sense to expect that important motivations trigger earlier (compared to unimportant ones) registration to the travel behaviour change program.

A third behavioural intuition, which is supported by a well-established line of empirical research in the behavioural sciences (e.g. Haidt, 2001; Nisbett and Wilson, 1977), is that people have difficulty in correctly recalling and reporting the true motivations underlying their behaviours. This may be expected to be particularly true, when those motivations are relatively unimportant to them.

Combining these three intuitions, we argue that motivations reported by early adopters are more likely to be true (i.e. correctly recalled) motivations, compared with motivations reported by late adopters.

A fourth intuition is that when people are asked to cite their motivations for a particular behaviour (in our case: joining the travel behaviour change program) and they do not recall precisely what their motivations are, they are relatively likely to cite 1) one or more random motivations or 2) a generic (bland) motivation or 3) a socially desirable motivation.

Combining these four intuitions, we argue that motivations cited by late adopters are relatively likely to be randomly cited ones, generic (bland) ones, or socially desirable ones.

In sum, this line of argumentation provides a clear path of reasoning to expect that motivations cited by early adopters are more likely to be the true ones, compared to those cited by late adapters; and that the latter ones are relatively likely to be either random, generic, and/or socially desirable. This in turn allows us to identify the importance of cited motivations by not only looking at their relative *frequency*, but also at their *latency*, i.e., the time between the start of the marketing campaign and their citation.

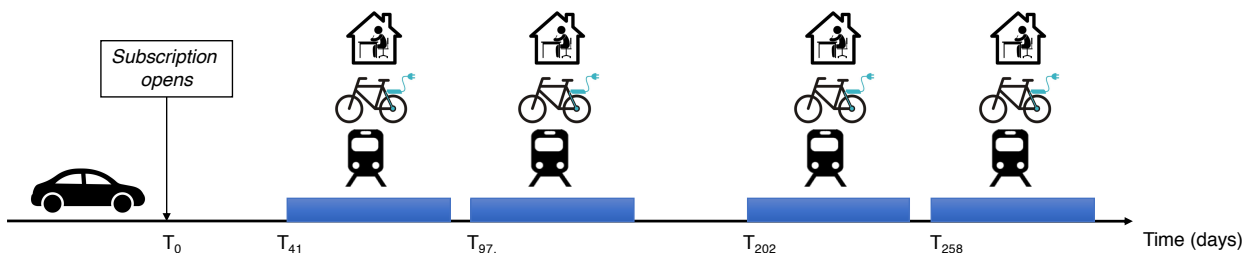
## **3. CONTEXT AND METHODOLOGY**

This section provides a more detailed description of the voluntary behavioural change program, the collected data, and the modelling approach and validation.

### ***Behavioural change program***

TU Delft has seen a major increase in the number of students over the past ten years, at the same time the campus houses increasing numbers of start-ups and larger companies. As a result, accessibility and liveability of the campus are at risk and space becomes sparser. One direction for a solution is a reduction in car use by 10% in 2025 compared to the level of 2018. Hence, they set up a program that aims to help achieve this goal.

The program allowed students and employees of the university who commute by car at least three times per week to test an alternative way of travelling for free for a period of eight weeks. To ensure that many people could participate, the program was organised in four blocks; March–May, June–July, September–October, and November–December (see Figure 1). Participants could choose the block they wanted to participate in, given availability. The program required that participants travelled to work by e-bike or public transit at least twice a week and that they worked from home at least four times during the whole period of the program (8 weeks).



**Figure 1: Visual representation of the behavioural change program**

### ***Data***

The behavioural change program was evaluated by collecting both stated (through surveys) and revealed (through travel diary and GPS/smart card trip data) data among the participants on their previous commuting behaviour, behaviour during the program, and their commuting behaviour three months after the program ended. Furthermore, motivations, attitudes, and experiences were questioned for the evaluation.

For this research, we use the survey that was distributed among the participants via e-mail right after they signed up for the program. This survey was obligatory for all participants (unlike the follow-up surveys) and needed to be completed before the participant could start the program. One question addressed the motivation(s) for participating in the program, where a total of ten reasons was distinguished and multiple reasons could be selected:

- I am often in a traffic jam
- To reduce travel costs
- To reduce travel time
- To be able to work/study during travel
- I can do other things during travel
- To prevent having parking issues
- To arrive more relaxed at work
- To contribute to a better environment
- Out of curiosity
- For health reasons

A total of 482 employees and students registered for participation in the program, 35 of them participated twice (they tested two alternative ways to travel to campus). 38.4% of the participants is female and 61.4% male. 28.8% of the participants is student at the university, the remainder works at the university (as PhD, scientific staff, or support staff). Furthermore, the minimum age

of the participants is 18, the maximum age is 65 and the mean is 36.4 with a standard deviation of 11.9 years.

### ***Modelling and tentative validation approach***

The psychological salience of these stated reasons for joining the behavioural change program is investigated through their relationship with the response latency, starting from the 12<sup>th</sup> of February 2019 ( $T_0$  in Figure 1). On this day, the program was marketed to all employees and students through various means, and registration opened up. We investigate this relationship in two ways, and subsequently we adopt two approaches for partially validating our findings.

#### ***Modelling***

First, we investigate whether there is a difference in response latency of participants that have mentioned a particular reason versus participants that did not give that reason. This provides insights in the importance of each reason as a motivator for joining the program. In a second step, a multiple linear regression model is estimated, in which response latency is specified as the dependent variable and the reasons to join as the explanatory variables (Field, 2009).

#### ***Validation***

To provide a tentative and partial validation of our theory, we adopt two approaches. First, we revisit our theoretical expectations in light of the substantive results of our study, to see if they align. Second, we have collected data on the commuting behaviour of participants before they joined the program and also three months after the program ended. Therefore, we are able to identify whether the program has resulted in a long term change in the car commute behaviour of participants (Ton and Duives, 2021). A total of 82 participants who have tested the e-bike in the first two blocks, have also completed the final evaluation survey. By comparing the response latency of the participants who changed their behaviour in line with the goal of the program (reduced car use) with those who did not, we are able to reflect on, and tentatively validate, our hypothesis that those who had a shorter response latency exhibited a stronger motivation to change their travel behaviour.

## **4. RESULTS AND VALIDATION**

In this section the results of the analysis on the relationship between motivators for joining the voluntary behavioural change program and response latency are discussed together with a partial validation of our approach.

The maximum theoretical response latency is 258 days (see Figure 1), due to the starting date of the fourth block. The last person to sign up for the program did so on day 253. On average, participants registered 83.1 days after launch. Table 1 shows the mean and standard deviations of the response latency for each motivation, both for those that cited it and those who did not. Furthermore, via independent t-tests we verified whether the differences between these groups were significant.

Looking at the *frequency* of citations, as shown in the second column from the left, motivations related to the environment, health, curiosity, and reduction of travel cost stand out as particularly important (see Table 1). Reasons that seem unimportant, from a frequency point of view, are the ability to do things during travel and work/study during travel. The right most column shows that, according to *latency*, being in a traffic jam, being able to work/study while travelling, and health reasons are particularly important motivators. Interestingly, also participants *not* signing up to achieve travel cost reduction, travel time reduction, to arrive more relaxed at work, and out of curiosity have registered relatively early. In other words, even though these participants were motivated to sign up early, they did *not* do so for these reasons.

**Table 1: Response latency in days after initiation depending on whether the reason was given or not**

Motivation for joining the program	Share of participants that cited motivation	Response latency of group that <u>did not</u> mention motivation	Response latency of group that <u>did</u> mention motivation
		Mean (st.d.)	Mean (st.d.)
To contribute to a better environment	62.9%	82.1 (88.7)	83.7 (85.7)
For health reasons *	58.7%	93.8 (87.9)	75.6 (85.2)
Out of curiosity *	44.2%	73.5 (82.6)	95.3 (90.5)
To reduce travel costs *	40.9%	74.3 (83.3)	96.0 (90.2)
To arrive more relaxed at work *	33.6%	72.2 (81.9)	104.7 (92.2)
I am often in a traffic jam	28.8%	86.1 (86.8)	75.9 (86.6)
To prevent having parking issues	28.6%	83.0 (86.5)	83.5 (87.6)
To reduce travel time *	28.2%	74.5 (83.1)	105.1 (92.1)
To be able to work/study during travel	3.9%	83.3 (86.8)	79.2 (88.8)
I can do other things during travel	2.1%	82.8 (86.9)	96.2 (81.9)

NOTE: \* Significantly different at 99% (p<0.01)

The results of the multiple linear regression model are depicted in Table 2. A positive coefficient on the response latency is cited by late applicants, and hence is regarded as a relatively weak motivator, whereas a negative coefficient is considered a relatively strong motivator. Reasons that are considered strong motivators are: often being in a traffic jam, being able to work/study during travel, and for health reasons (in line with the findings in Table 1). Especially the latter (health reasons) may be considered a strong motivator in terms of significance and effect size. Reasons that are considered weak motivators are reduction of travel costs, reduction of travel time, arriving more relaxed, and out of curiosity. The remaining reasons (doing other things during travel, preventing having parking issues, and contributing to a better environment) are not considered particularly weak or strong motivators, as they do not affect the response latency and thus seem to be equally mentioned by everyone.

**Table 2: Linear regression model with response latency in days after launch as dependent variable**

	Coefficient	SE	$\beta$
Constant	67.33	9.11**	
For health reasons	-24.42	8.30**	-0.14
I am often in a traffic jam	-11.67	8.76	-0.06
To be able to work/study during travel	-10.55	20.8	-0.02
To contribute to a better environment	0.66	8.16	0.01
To prevent having parking issues	0.31	8.67	0.00
I can do other things during travel	3.98	27.4	0.01
To reduce travel time	16.76	8.91*	0.09
Out of curiosity	20.99	7.85**	0.12
To reduce travel costs	22.39	8.10**	0.13
To arrive more relaxed at work	30.22	8.25**	0.17

NOTE: R<sup>2</sup> = 0.092. \*Significant at 90% (p < 0.10), \*\* Significant at 99% (p < 0.01)

Table 3 shows the assigned importance rank of each motivator according to frequency of citation (an often-used method) and response latency (based on the abovementioned results). The motivator that is considered most important according to the frequency approach (better environment) is not that important when considering latency (it is neutral, neither weak nor strong). We find alignment between the two methods in the high importance that is assigned to health reasons. On all other accounts we see misalignment. A Kendall's tau rank order correlation equals zero, implying

that the frequency rank order is uninformative of the latency rank order. Hence, we can conclude that frequency and latency each measure a separate dimension of motivational strength.

**Table 3: Comparison of importance of frequency and latency for motivations to join the program**

Reason for joining program	Importance according to	
	<i>Frequency</i>	<i>Latency</i>
To contribute to a better environment	1	4
For health reasons	2	1
Out of curiosity	3	6
To reduce travel costs	4	7
To arrive more relaxed at work	5	8
I am often in a traffic jam	6	2
To prevent having parking issues	7	4
To reduce travel time	8	5
To be able to work/study during travel	9	3
I can do other things during travel	10	4

To tentatively assess the validity of our theory we first examine the data and results in light of the behavioural intuitions that were formulated in section 2. We focus on the fourth intuition which stated that, when people are asked to cite their motivations for a particular behaviour and they do not recall precisely what their motivations were, they are relatively likely to cite 1) one or more random motivations or 2) a generic (bland) motivation or 3) a socially desirable motivation.

Related to (1) it is interesting to note that respondents who registered at a relatively late point in time, generally selected more reasons than those with who registered early, as indicated by the small (yet significant) positive correlation between response latency and the total number of stated reasons ( $r=0.13$ ,  $p=0.004$ ). This aligns with the intuition that people who correctly recall their reason(s) for joining the program will indicate these specifically, whereas those who cannot recall exactly the specific reason(s) will be likely to check multiple boxes in a more random fashion.

Related to (2) it can be observed that the reason “out of curiosity”, which can clearly be identified as a generic (bland) motivation, is indeed quite strongly associated with a higher response latency. Hence, people who cannot recall any specific motivation, and thus are more likely to resort to this generic reason, register at a late moment in time.

Finally, related to (3) the reason “to contribute to a better environment” is arguably the only reason in the complete set that can be identified as a socially desirable answer. People who indicated this reason on average also applied at a relatively late moment in time (at least compared to those who cite more self-interested reasons such as travel costs, being able to work during travel and health reasons).

The second approach we use to tentatively validate our theory is to examine the relationship between response latency and the long-term change in car commute intensity. We hypothesise that participants that have decreased their car commute on the long term, have registered earlier than those who did not show the desired result. If so, this would show partial evidence that response latency indeed is a sound proxy to capture motivation (both for participation and actual change). Data show that 43 of the 82 participants (52%) have decreased their car use for commuting.

Table 4 shows the mean and standard deviation of response latency for the participants that decreased their car commute intensity after the program ended versus those who did not. Note that these participants only participated in the first two blocks of the program, therefore the maximum response latency is 97 days. The participants that show a decrease have a lower average response latency compared to those who show the opposite effect, which is in line with our hypothesis. However, this difference is not significant.

**Table 4: Response latency versus long-term behavioural change**

Car commute intensity after program	Response latency (days)		
	Mean	Std. Dev.	N
Decrease	15.26	12.3	43
No decrease	16.92	15.8	39

While these two approaches to validate our results generally support the formulated behavioural intuitions, more research is necessary to provide further evidence in favour of our suggestion that latency should be considered a useful proxy of motivational strength.

## 5. CONCLUSIONS

Understanding the importance of motivations for participating in behavioural change programs can help in designing and marketing future voluntary behavioural change programs to the public. This paper introduced a novel ‘proxy’ criterion to assess psychological significance of motivations (‘motivational strength’) for participating in a voluntary behavioural change program. This idea was tested and tentatively validated in the context of a voluntary behavioural change program organised by TU Delft.

According to our measure, the weakest motivators that were found are curiosity, arriving more relaxed at work, and reducing travel costs or travel time; the strongest motivator for participating in the program is found to be health related, which is indeed a reason which was also mentioned frequently. The combination of frequency- and latency-based proxies suggests that only if an individual wants to change their health and views a change in commute as an option to do so, are they strongly motivated to participate in a behavioural change program.

Based on these results, we argue that future voluntary behavioural change programs should have a stronger focus of their marketing and programs on the health of individuals, as this will provide a stronger motivation for participation and change of behaviour. In terms of methodology, we advocate the joint use of frequency- and latency-based proxies to assess the relative strength of motivations cited for joining behavioural change programs. Clearly, on our data these two proxies appear to measure different aspects of motivational strength, suggesting that their joint use provides a richer, more complete and hence more reliable picture of a cited motivation’s psychological salience.

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