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The ‘re-norming’ of working from home during COVID-19: A transtheoretical behaviour change model of a major unplanned disruption

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ABSTRACT

Significant disruptive events have the potential to change travel behaviour in the long-term. COVID-19 has caused the most significant disruption of travel behaviour in living memory. One of the most notable changes has been the increase in working from home, which was forced upon many workers during lockdowns and ‘stay at home’ orders. But much is still unknown about the long-term impacts of those changes. This study explores the influence of the COVID-19 pandemic on changing work from behaviours using the Transtheoretical Model of behaviour change. The Transtheoretical Model has been widely used to study behaviour change in health, with some application to travel behaviour change. In this paper, we explore whether people’s ‘stage of change’ before COVID-19 has an impact on their long-term intent to work from home. We found that only 12% of respondents had considered working from home more before COVID, yet those that had were far more likely to intend to work from home in the long term. In addition, we unpick the influence of ‘process of change’ factors, some of which point to a potential ‘re-norming’ of attitudes toward working from home. Although self-efficacy (feeling capable to work from home) was an important factor, it was not as important as the attitudes of employers and colleagues toward working from home. Implications of the findings for research and practice are explored.

1. Introduction

Significant disruptive events can become windows of opportunity for travel behaviour change. Both planned events (such as the Olympics) and unplanned events (such as severe weather or a pandemic) disrupt travel behaviour in the short term. Under the right circumstances, these events have been demonstrated to change travel habits in the long term (Parkes et al., 2016; Marsden et al., 2020). Marsden et al. (2020) suggested that during periods of disruption, the boundaries of expected travel behaviour may shift, resulting in the creation of new norms (i.e. ‘re-norming’).

More recently, the COVID-19 pandemic has caused the most significant disruption to travel behaviour in living memory. One of the most notable changes in travel behaviour is the increase in working from home (WFH) and the corresponding reduction in commute travel (Brynjolfsson et al., 2020; Currie et al., 2021; Jain et al., 2022). Yet there is still much uncertainty over how sustained these changes to WFH will be, and to date few of these studies have drawn from established theories that explain long term behaviour change (van Wee and Witlox 2021).

The Transtheoretical Model of change, originating in the health literature, describes the different stages of behaviour change and identifies ways to support people making these changes (Friman et al., 2017). It has also been used to characterise short- and long-term travel behaviour change in response to planned disruptive events (the Olympic Games, Parkes et al., 2016). Although one paper has used the concept to explore changes in physical activity during COVID-19 (Faulkner et al., 2020), to date, no studies have applied the transtheoretical model in the context of unplanned travel disruptions or to changes in work from home behaviours.

The aim of this study is to apply the Transtheoretical Model of behaviour change to understand the factors that influence WFH during and after the COVID-19 pandemic. Based on the Transtheoretical Model, we hypothesise that prior experience of working from home affects the likelihood of maintaining this behaviour in the long term. We also explore whether there is any evidence that social norms, or re-norming of attitudes, could play a role in long-term intent to work from home.

The paper is structured as follows. The next section outlines the state
of research on the impact of COVID-19 on WFH and describes how the Transtheoretical Model has been applied in transport research. It then provides a description of the survey data used in this study and the analytical method applied. After presenting the findings in light of the Transtheoretical Model, the paper closes with a discussion of the findings in light of past studies and provides suggestions for policy and future research.

1.1. Literature review

For decades, transport researchers have been studying ways to change travel behavior to improve the sustainability of travel. Just before the outbreak of COVID-19, Marsden et al. (2020) explored the potential for disruptive events (such as flooding or bridge closures) to change travel behavior in the long-term. They found that many people employed a range of travel adaptations, such as re-timing, relocating or cancelling trips, and challenged the contention that travel behavior is stable and resistant to change. In addition, they found preliminary evidence of re-norming of travel behavior, a significant adjustment of expectations and norms, particularly around remote working (Marsden et al., 2020). Note that social norms are also a significant component of the Theory of Planned Behaviour, a theory of behavior change commonly applied in travel behavior research (Ajzen 1991).

In addition, unlike past pandemics such as SARS or swine flu, COVID-19 may be the first natural disaster to cause a ‘substantial and supranational’ change to the transport system (Van Cranenburgh et al., 2012). COVID-19 may provide the ultimate disruption of travel behaviour, particularly around commuting and remote working. There is already significant evidence that WFH has significantly increased in the short-term. This forced disruption may result in re-norming of attitudes toward working from home, increasing the adoption of WFH in the longer term.

1.2. COVID-19 impacts on working from home

COVID-19 has caused a shift from working in offices to working from home in many countries, facilitated by the implementation of new communication technologies and policies (Belzunegui-Eraso and Erro-Garcés 2020).

Early research on work from home (or teleworking) during COVID-19 measured increases in many countries (e.g. Bick et al., 2020; Hensher et al., 2020; Molloy et al., 2020; Koohsari et al., 2021; Jain et al., 2022). Although rates of working from home vary by country, some increase during the pandemic has been generally universal. At the time of writing it is unclear how WFH rates will change in the long-term as variants of concern continue to emerge. Studies from early in the pandemic (when there was still a belief that the pandemic would have a clear ending) suggest that WFH rates will decline from the levels experienced during active waves of the virus but will not return to the relatively low levels of behaviour prior to COVID-19. Currie et al. (2021) found that WFH per day in Melbourne increased by 310% in lockdown compared to pre-COVID levels and that self-reported expectations of WFH ‘after the virus has gone’ was 75% higher than pre-COVID levels. Almost two thirds of respondents in one European study hoped to work from home more ‘after the pandemic’ (Baert et al., 2020). In another study more than a third wanted increases in WFH ‘after COVID’ (Rubin et al., 2020). A longitudinal study from the UK found that around half of respondents were still working from home at least partially by mid-2021 (Marsden et al., 2022).

In summary, preliminary evidence suggests some of the increase in WFH behavior will be maintained in the long-term. Yet much is still unknown about why some workers will maintain higher rates of WFH whereas others will not. The Transtheoretical Model is a demonstrated framework for understanding and supporting behavior change. In this paper, we apply the concepts of this model to better understand the barriers and incentives to WFH in the future. In addition, we will use this framework to explore whether re-norming of attitudes toward WFH might be playing a role. Getting a better understanding of these underlying factors can help transport planners to anticipate the changing demand for commuting.

1.3. The transtheoretical model of behaviour change

The Transtheoretical Model is widely used to study behaviour change, particularly in areas of public health such as smoking cessation or increasing exercise (Prochaska and DiClemente 1984). Unlike other behavioural theories commonly used in transport, such as the Theory of Planned Behaviour or Social Practice Theory, the Transtheoretical Model was developed specifically to study change in behaviour. It is comprised of four theoretical constructs: the ‘stages of change’, the ‘process of change’, self-efficacy and decisional balance (see Fig. 1). The basis of the framework are five stages of change whereby people move through pre-contemplation (not considering change), contemplation (considering change), preparation (preparing to change), action (trying a new behaviour) and maintenance (maintaining the new behaviour) stages.

However, the stages of change are underpinned by a broad range of mental and behavioural ‘processes of change’ factors that support and influence each stage of change (Prochaska et al., 1988). Examples of processes include consciousness raising (being aware of the new behaviour), helping relationships (friends/family support the behaviour change), social liberation (changes in societal expectations), stimulus control (controlling the situation around the behaviour) and counter-conditioning (breaking mental associations with the undesired behaviour). The original list of ten processes proposed by Prochaska et al. (1988) have since been expanded, with researchers choosing which processes to measure or target depending on the behaviour studied (Parkes et al., 2016; Friman et al., 2017).

As individuals move through these stages of change, the behaviour begins to feel ‘easier’ to enact and maintain, resulting in an increase in self-efficacy. And finally, as people move through the stages of change the benefits of the new behaviour start to outweigh the disbenefits (known as ‘decisional balance’). However, self-efficacy and decisional balance are conceptualised as moderators of change, rather than directly influencing change (Lipke et al., 2009).

1.4. Examples of transtheoretical model applications in travel behaviour research

A number of studies have applied the Transtheoretical Model to understand travel behaviour change (Friman et al., 2017). Faulkner et al. (2020) is the only study we found that applied the Transtheoretical Model to travel behaviour change in response to the COVID-19 pandemic. In that paper, the emphasis was on changes to physical activity (such as going to the gym) as well as walking or cycling. They measured respondents’ stage of change from the Transtheoretical Model (Fig. 1) in terms of intention to undertake physical activity before COVID-19 and during COVID-19. None of the process of change factors influencing intention to change behaviour were explored. Results demonstrated significant increases in the share of respondents in the Action, Preparation and Contemplation stages during COVID-19 compared to pre-COVID, whereas the share of those in Pre-Contemplation (no intention to change) fell slightly between pre-COVID and during COVID. However, this study has a number of limitations. It did not measure any of the ‘process of change’, self-efficacy or decisional balance factors associated with the Transtheoretical Model (Fig. 1), and the emphasis was on physical health rather than travel behaviour per se.

Indeed, the majority of studies applying the Transtheoretical Model to travel behaviour focus on increasing health-related behaviours such as cycling to work (Friman et al., 2017). Yet these studies either examine a behaviour in its ‘default’ setting, or after a short intervention (such as a
‘ride to work’ day) (Rose and Marfurt 2007). COVID-19 is a much more significant and wide-ranging disruption to people’s travel behaviour.

Perhaps more relevant to this paper is a study of the impacts of the London 2012 Summer Olympic games on long-term commuting (Parkes et al., 2016). A critical application of the Transtheoretical Model was undertaken where the Stages and Processes of Change were measured for respondents before and after the event. Although overall changes in travel behaviour after the event were quite modest, Fig. 2 suggests that stage of change had a significant impact on long-term travel behaviour change: those who had an intention to change travel behaviour before the games were almost twice as likely to sustain travel behaviour change in the long-term.

In summary, the Transtheoretical Model of behaviour change provides a tested framework to explore the factors that may influence whether people increase working from home in the long-term. There is also some suggestion that when disruptions occur, travel behaviour can be shaped by re-norming of attitudes and beliefs. Therefore, this paper will explore two primary research questions:

- Can the Transtheoretical Model provide insights into who is more likely to increase work-from-home in the long term?
- Is there evidence that re-norming of attitudes contributes to increased work-from-home in the long term?

2. Method

The research aims to understand factors influencing long-term changes in working from home (WFH) behaviour using the Transtheoretical Model framework. We explore this aim using a primary survey comparing pre-COVID, during-COVID and predicted post-COVID WFH behaviour. The case study is drawn from the population of Melbourne, Australia in mid-2020. The study context, primary research and analytical approach are now outlined.

2.1. Study context

Primary research used an online questionnaire with a sampling frame designed to get a representative sample structured by income, age and location in Melbourne. Three locations were sampled; inner, middle and outer Melbourne. For each region of Melbourne, the share of the population in three age and income cohorts were identified from the census. The sampling frame was designed to achieve a survey sample that matches the census on these characteristics. A complete and detailed description of the survey and sampling approach is described in (Currie et al., 2021).

Originally, data collection was planned for a period of 6 weeks in mid-2020, beginning on 26 June, approximately a month after Melbourne exited its first period of ‘stay at home’ orders. However, Melbourne re-entered a period of lockdown on 8 July, interrupting data collection. After a pause of one week, data collection continued for several more weeks, eventually collecting 2163 responses. However, because this study is interested in travel behavior ‘between lockdowns’, in this paper we will only consider the 928 responses from before the second lockdown commenced. Of those, 563 were employed before COVID and expected to be employed in the future.

The questionnaire collected respondents’ travel and work from home behaviors pre-COVID and during COVID (in lockdown, between lockdowns) and sought their self-reported expectation of behaviors ‘after the virus had gone’, which we term the ‘post COVID-19’ period. Note that we did not specify the time scale for ‘when the virus had gone’, as at the time no-one knew how long the pandemic would last. Although we asked people to classify their job into general categories (manager, professional service, technician/trades, community services, clerical/administrative, sales, machinery operator/driver, laborer and ‘other’), this is not a perfect representation of whether one’s job was able to be conducted at home. We categorized these jobs into ‘white collar’ vs ‘blue collar’ in later analyses, but acknowledge that some ‘white collar’ jobs

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**Fig. 1.** The Transtheoretical Model, stages of change and process of change. Adapted from (Nigg et al. 2011, Parkes et al., 2016)

**Fig. 2.** Intent and actual change in behaviour – planned disruption (London 2012 olympics and commuting behaviour). Source: Parkes et al. (2016).
For the purpose of this study, the survey also collected information about stages of change, process of change, self-efficacy, decisional balance and demographics.

A range of other questions around travel behavior and attitudes were also collated during the survey but are not reported in this study.

2.2. Measuring the transtheoretical model components

To classify respondent ‘stage of change’, respondents were asked to identify their intention to work from home for before COVID-19 using the question wording in Table 1. Most respondents to the survey (79%) were in the ‘pre-contemplation’ stage before COVID.

Table 2 shows the survey questions that were used to operationalise the process of change, self-efficacy and decisional balance measures in the Transtheoretical model. In each case respondents were asked to state the extent to which they agree or disagree with the statement on a scale from 1 (disagree strongly) to 7 (agree strongly). Where multiple questions could be used to operationalise a concept, a factor analysis was conducted to confirm that the questions were measuring a single factor and Cronbach’s alpha confirmed the validity of the measure. Although the literature identifies potentially dozens of ‘process of change’ measures, the three constructs of ‘helping relationships’, ‘social liberation’ and ‘stimulus control’ were considered the most relevant for this study.

Note that the ‘helping relationships’ and ‘social liberation’ factors are examples of social norms that could be considered proxy indicators of re-norming. More than the other factors, these two measure social norms toward WFH, whereas stimulus control and self-efficacy are similar to ‘perceived behavioural control’ and decisional balance is similar to an ‘attitude’ as applied in the Theory of Planned Behaviour (Ajzen 1991). If any of these factors are significant barriers, we would expect to see a significant association between these measures and intent to WFH in the future.

2.3. Analytical approach

Descriptive results will illustrate the extent of working from home before, during and (self-reported) ‘after’ COVID-19. We then present a breakdown of respondent stage of change and their WFH before, during and ‘after’ COVID-19 and compare these results to the findings from the London Olympic Games (Parkes et al., 2016).

To test whether the process of change influences vary across the stages of change (in line with the Transtheoretical Model), a MANOVA was run comparing the average scores across four stages of change. MANOVA relies on several assumptions, including multivariate normality. The sample size in the four categories was uneven (many more respondents were in ‘pre-contemplation’ than the others stages, see Table 1); as a result, Box’s Test of Equality of Covariance was significant, showing that the assumption of multivariate normality was violated. For this reason, only Pillai’s trace criterion was used to assess whether the process of change values differed between stages of change (Hintze 2007).

Finally, we will apply a logistic regression model to predict who is more likely to report that they will work from home ‘when the virus has gone’ (based on the assumption in mid-2020 that the pandemic would have a finite end). The model uses the Transtheoretical Model Stage and process of change variables as the independent variables of interest. In addition, we ran a version of the model including whether or not someone increased work-from-home between waves of the virus (when they had the opportunity to return to work). This additional time working from home may have provided respondents additional time to renorm toward WFH.

3. Results

Fig. 3 shows the frequency of working from behaviours pre, during and post COVID including a split of results between and during lockdown. WFH in general and WFH 5+ times a week in particular increased significantly during COVID. The amount of WFH in the short time between lockdowns decreased, with the proportion saying they did not WFH increasing from 44% to 50%. WFH intent post COVID is much higher than pre-COVID but below levels experienced during the pandemic.

Fig. 4 shows actual and intended future work from home behaviours
of those who intended to change behaviour pre-COVID compared to those who didn’t intend to change behaviour. This graphic is a direct comparator to Fig. 2 for travel behaviour in the London 2012 Olympic Games (from Parkes et al., 2016). It shows WFH during COVID-19 for the between-lockdown period since this is more likely to be associated with voluntary WFH behaviour (rather than forced WFH during lockdowns).

Overall, 24.6% of respondents said they would WFH more ‘after COVID was gone’, including both people who had intended to change behaviour (contemplation and preparation) and those with no intent (pre-contemplation). Consistent with Parkes et al. (2016), stage of change influenced behaviour change. Some 51% of those in contemplation or preparation stage before COVID increased their WFH between lockdowns; in contrast only 39% of those without intent increased their WFH. After COVID-19, 64% of those with intent to change behaviour pre-COVID thought they would continue WFH. Only 58% of those without intent thought they would WFH after COVID.

Note that unlike Parkes et al. (2016), the majority of respondents (79%) were in pre-contemplation, meaning they had no intent to WFH more before COVID-19. For this reason, the majority of people in the survey who say they will increase WFH after COVID – 19.6% out of the 24.6% of increasers - actually had no intent to change behaviour before COVID (see the final column in Fig. 4). The implication is that the majority of post-COVID WFH behaviours are made by those with no intent thought they would WFH after COVID.

Table 3 shows the results of a binary logistic regression predicting whether someone states they will work from home ‘when COVID-19 has gone’. Two versions of the model were run. Model A included the stage of change people were in before COVID-19 (Table 1), process of change factors, self-efficacy, decisional balance and demographics. Model B included a measure of whether the respondent increased their days working from home ‘between waves’ of COVID. These people would have had a greater opportunity to re-norm their behaviour as they continued to work from home even after restrictions had eased. In a sense, they had moved into the ‘action’ stage of change during the pandemic.

Both models showed a strong statistical fit with a significant Chi-square test and pseudo- $R^2$ values between 0.37 and 0.52. The two models had very similar results though Model B, including the re-norming effect, had a slightly higher statistical fit.

In both models the stages of change variables and most process of change variables were associated with working from home post-COVID. Interpreting the odds ratio, compared to people who were not contemplating WFH pre-COVID, people who were in the contemplation/preparation stage were nearly three times more likely to declare an intention to WFH post-COVID, and people who had tried WFH pre-COVID were twice as likely to work from home after COVID compared to those who didn’t WFH between waves.

In addition, almost all of the process of change measures were statistically significant predictors of WFH post-COVID. For every one-point increase in the survey measures of ‘helping relationships’ and ‘social liberation’, people were about 1.4 times more likely to WFH post-COVID. ‘Stimulus control’ was significant in Model A but with a lower effect size of about 1.2 times greater likelihood. In Model B this variable was not significant although it was in the same direction as in Model A.

Self-efficacy was higher among people who said they would WFH post COVID with a 1.3 times greater likelihood for every point increase on the survey scale. However, decisional balance (pros vs. cons) was only a marginally-significant predictor of WFH post-COVID ($p = .07$). These findings echo Table 3 and suggests that relationships and social influences are relatively more important than other factors in WFH.

The only demographic variable that was statistically significant was whether someone was a white-collar worker, which approximately doubled the odds of WFH post-COVID.

4. Discussion and conclusions

This study uses the Transtheoretical Model of behaviour change to explore the potential long-term influence of COVID-19 on changing work from home practices. It also explored whether ‘re-norming’ toward

Fig. 4. Intent and actual change in behaviour – unplanned disruption (COVID-19, working from home).
working from home could be playing a significant role in these changes (Marsden et al., 2020).

Before COVID-19, the majority of respondents (79%) had no intent to increase their WFH, and only 24.6% of respondents stated they would WFH more ‘after the virus was gone’. Yet, consistent with the Transcomputational Model, those with greater intent to increase WFH before the pandemic increased their WFH behaviours during and after the pandemic more than those with no intent.

These findings are consistent with the only other study to apply the Transcomputational Model to a significant disruption, the London Olympic Games (Parkes et al., 2016). It is notable that a far higher share had expressed intent to change their commute behaviour in response to the London Olympics (60%) compared to intent to increase work from home before to the unplanned event of COVID-19 (12%). Obviously, a planned event permits a greater degree of preparation than an unplanned event. But interestingly, the London Games had a very small long-term influence on travel (about 6% actually changed commuting), whereas this paper suggests that 24.6% of respondents intend to increase working from home in future. These findings suggest it is worth unpacking which ‘process of change’ factors may be playing a role in long-term changes to WFH behaviour. For example, the technology to facilitate working from home has improved significantly since the London Olympics.

A logistic regression model found that constructs from the Transcomputational Model including stages of change variables and most process of change variables were associated with intent to increase working from home post-COVID. The one exception was decisional balance, which was not a significant predictor when other factors were taken into account. This does not mean that decisional balance is not involved with decisions to WFH. Decisional balance scores were overall quite high (average score across the survey was 4.7 on a 7-point scale), suggesting that for many people, working from home provided them with more benefits than disbenefits. However, it does suggest that an individual’s desire to work from home is not as important as external constraints.

Interestingly, the factors most closely aligned with social norms appeared to have the strongest influence on WFH intent. Overall, negative attitudes of colleagues and employers were playing a significant role in dampening WFH before COVID, and ‘re-norming’ of these attitudes may be taking place. More recent reports suggest that employer attitudes are shifting, although there is still a gap between how managers and employees view their productivity when working from home (Williamson and Colley 2022). Yet for every workplace with increasingly flexible WFH policies, there are other examples of employers demanding that their workers return to the office (a prominent example occurred in June 2022 when Elon Musk ordered Tesla workers to return to the office full-time or lose their jobs (Isidore 2022)). The implication is that policies to encourage WFH behaviours should target the attitudes of employers and workplace cultures, rather than changing the attitudes of individual workers.

Further research in this area might draw from frameworks such as Social Practice Theory (Shove et al., 2012; Burklinshaw 2018; Kent 2022) to unpack precisely which materials, meanings and skills are acting as barriers or facilitators. In the years since the pandemic began, many workplaces have likely implemented the materials needed to work effectively from home. However not all workplaces or individuals may have the skills needed to effectively use these materials. And the meaning (or social norms) attached to WFH may significantly differ between employers and employees. Only by understanding the interrelations between these constructs can we meaningfully target policy or practice to encourage greater working from home.

Future work should also consider the intersection between materials, meanings and skills across different industries and work sectors. One of the limitations of this study is that it could not distinguish with certainty between jobs that can take place at home vs. jobs that cannot be done at home (such as cleaning, transport/logistics or hospitality workers). If the transport and land-use systems evolve to support the needs of the ‘work from home’ class, what are the implications for workers who cannot take advantage of these changes? For example, if transit authorities reduce their services because of reduced demand among white-collar workers, this limits access to jobs for blue-collar workers who cannot work from home.

As Marsden et al. (2020) and Van Cranenburgh et al. (2012) have found, significant societal disruptions can have sustained impacts on long-term travel behaviour. This research only considered the first few months of Melbourne’s lock downs in 2020. In the intervening years, it is likely that social norms and practices have continued to evolve. Longitudinal studies suggest that increased working from home will be sustained in the long-term (Marsden et al., 2022). Understanding the materials, skills and meanings around work are important determinants of whether people and businesses support work from home in the long term (Burkinshaw 2018). We must invest the time and research into understanding the levers behind this change if we wish to harness this disruption to encourage a more sustainable transport and land-use system.
**Author contribution statement**

Dr Alexa Delbosc undertook data analysis and early drafting of the paper. Prof Currie directed the research including research design, field survey and questionnaire design and finalised drafting of the paper. Dr Taru Jain managed the field surveys, was involved in questionnaire design and provided feedback on the paper. Dr Laura Aston undertook background research on the Transtheoretical Model, was involved in questionnaire design and provided feedback on the paper.

**Data availability**

The authors do not have permission to share data.

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