Innovate UK

Combo Travel

Active and motorised modes working better together

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Summary

This paper considers the concept of Combo Travel: human-powered mobility in combination with a motorised mode as an enabler of healthier lifestyles and lower carbon journeys. Most journeys by motorised modes (bus, train, tube, car, van etc.) also involve some element of human-powered mobility at either end – from a few steps to the front door from a parked car, to a cycle ride to the train station. Combo Travel goes further by explicitly seeking to optimise for and increase the active aspect of everyday journeys and commutes.

Combo Travel is distinct from the popularised concept of Mobility-as-a-Service (MaaS). Combo Travel is specifically focused on encouraging and enabling active travel; whereas MaaS is largely focused upon selling access to (motorised) mobility. Combo Travel (independently or as part of an evolution of MaaS) could be a significant ingredient to future transport because of the multiple policy priorities that it could help to address. In this sense it might be considered a 'super-policy': supporting public health, supporting motorised transport services, supporting transport decarbonisation and promoting economic prosperity.

As an under-explored and under-developed phenomenon, Combo Travel would seem deserving of further attention. This paper provides an examination of literature to understand the state of the art in conceptual and empirical terms as it relates to active travel undertaken in combination with motorised travel. It then adds further insights from stakeholder engagement to explore views concerning Combo Travel and highlight opportunities for future innovation.

The paper reveals a multitude of insights. Combining active travel with motorised travel is not a new phenomenon, though it has been evolving significantly in terms of form and function. Interest has been more concerned with transport planning than public health. There is little if any overlap as yet between research into personal activity trackers and into Combo Travel and yet the two could come together in an important way. Context matters when it comes to considering Combo Travel and this involves a multitude of factors relating to modes, ownership versus usership, different ends of a motorised journey, traveller characteristics and built environment characteristics. Combo Travel must be understood as more than the sum of active and motorised travel. It should be considered as a 'mode' in its own right and with a whole journey experience and perspective in mind. While Combo Travel readily relates to public transport, combining active travel with car use should also be considered, given the prospects for improving health and affecting the nature and extent of car traffic. Goods movement is also relevant, particularly given the rise in online shopping and deliveries, including the role of cargo bikes. Information provision is a key aspect of Combo Travel, yet existing provision has not been designed with Combo Travel in mind. There appears to be more insight concerning the behaviours associated with Combo Travel than regarding the impacts arising from Combo Travel. There remains a need to get to the heart of the user perspective in relation to Combo Travel and in turn to consider some rebalancing between a predominant focus on surveys and modelling, and opportunities for more in-depth qualitative research.

It is intended that this paper provides a resource that can help direct greater attention to Combo Travel and inform and inspire an appetite to better understand and progress it as a contributor to future transport. In so doing, the importance of traveller perspective comes to the fore. Any approaches to research and innovation should recognise and address the diverse makeup of the travelling public, seeking to understand their lived experiences that determine the context into which Combo Travel is, or could be, introduced.

Combo travel can take several forms, including ...

- greater provision for bikes on buses, or for secure bike parking to be added at bus stops to allow for different lengths of active journey depending on an individual's energy levels, mood, weather etc.
- intentionally designing a proportion of car parking provision, as well as individuals choosing to park by preference, further away from car journey destinations as part of active environments
- by preference, choosing to walk from home to a more distant bus stop to add steps, or linked to app-based incentives, or to free-up capacity at key times of day for those who need it most
- mobility hubs with amenities like dry cleaning, secure bike parking, towels and on-demand showers at transport interchanges
- park and ride, whereby the ride is a bike, e-bike or cargo bike
- car companies including fold-up bikes and e-bikes in the vehicle, either as a single, integrated branded offer or through brand partnerships
- integrated digital ticketing and app platforms that promote and incentivise active mode options, not least at peak times.

1 Introduction

This paper considers the concept of Combo Travel which we define as:

> **human-powered mobility in combination with a motorised mode as an enabler of healthier lifestyles and lower carbon journeys**

This holds the prospect of improving mobility services, public health and economic prosperity. The paper's purpose is to understand what insights already exist concerning Combo Travel, identify new considerations or possibilities, and outline recommendations for future research and innovation that could help advance the concept in the UK.

Active travel at the heart

Active travel can be described as human-powered mobility. It is the collective term often used to describe everyday cycling and walking as transport. Active travel incorporates (increasingly) diverse forms, including vehicle designs used by disabled cyclists and wheelers (people in wheelchairs) as well as scooters and skaters. To this can be added the growing array of e-cargo and electric bikes, which are partly assisted but principally human-powered, as well as all kinds of journeys on foot - including running.

Combo Travel is distinct from the popularised concept of Mobility-as-a-Service (MaaS). Combo Travel is specifically focused on *encouraging and enabling* active travel; whereas MaaS is largely focused upon selling access to (motorised) mobility. Combo Travel (independently or as part of an evolution of MaaS) could be a significant ingredient to future transport because of the multiple policy priorities that active travel helps address.

As Public Health England put it: *"Switching more journeys to active travel will improve health, quality of life and the environment, and local productivity, while at the same time reducing costs to the public purse. These are substantial 'win-wins' that benefit individual people and the community as a whole"* (Public Health England, 2016: 4). Technology is helping unlock active travel - and may well partly explain the significant pre-pandemic growth in walking trip rates in England since 2015[1], against a backdrop of prior decline. The concept of Walking as a Service highlights how wayfinding apps can promote confidence to choose active travel options, giving a sense of independence and using the power of geography to connect people to businesses and promote economic activity (Lyons, 2020).

Active travel aligns the needs of people and place. If you plan and design for active travel and healthy streets, the benefits reach far beyond transport. They include health, wellbeing, reduced social isolation, improved air quality, reduced environmental and carbon impacts. It is why a former Chief Medical Officer called such everyday activity 'a wonder drug'[2]. *"Active commuting increases individual energy expenditure and is easy to incorporate in normal daily routine"* (Henriques-Neto *et al*., 2020: 1).

The time has come

Active travel has been given fresh impetus and increased priority by the UK Government as an enabler for getting the economy moving again whilst maintaining safe, social distancing in a pandemic and

1 https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/733109/nts0308.ods
2 www.sustrans.org.uk/media/4471/4471.pdf

post-pandemic era. This includes the 'Gear Change' announcement of £2bn investment for active travel which introduces a £250m active travel fund, and a £200m active travel for schools fund (DfT, 2020a). This is leading to many more instances of road space reallocation, 'filtered permeability', Low Traffic Neighbourhoods (LTNs) and traffic calming to give preference to modes other than private car[3].

A new public body – described as an active mobility equivalent to Ofsted – called Active Travel England, has been announced. As an inspectorate, this will have powers to withdraw funding if standards are not met or projects are subject to delays[4]. Active travel is also central to the UK's Transport Decarbonisation Plan (DfT, 2020b). And it is prominent in the push to reduce obesity, spearheaded personally by Prime Minister Boris Johnson (DHSC, 2020). This includes what No 10 has called "the biggest ever step change in cycling and walking"[5]. Among the policy measures are pilots to encourage GPs to prescribe cycling (and park runs) in areas with poor health and low physical activity rates, as well as further investments in secure bike parking and additional infrastructure.

There are some early indications that Combo Travel can be a useful framing for bus and train operating companies in enabling active travel, in improving their service offering as an alternative to a car-led recovery, and in meeting Net Zero goals. Both Go-Ahead Group and Stagecoach have engaged enthusiastically with the topic including pilots (e.g. bikes on buses)[6]. Train and bus station designs and amenities to improve customer experiences and better enable active travel in combination with public transport are also on their, and other operators', agendas. This said, the UK Department for Transport's newly published National Bus Strategy for England – 'Bus Back Better' – offers some but only very limited recognition of the prospects of active travel and bus travel joining forces (DfT, 2021).

Paper structure

The paper has two main elements: an examination of literature to understand the state of the art in conceptual and empirical terms as it relates to active travel undertaken in combination with motorised travel (Section 2); and further insights from stakeholder engagement to explore views concerning Combo Travel (Section 3). The final section of the paper reflects upon the overall paper to look ahead – concluding with the suggestion that promotion of Combo Travel may constitute a super-policy (Section 4).

3 www.forbes.com/sites/carltonreid/2020/07/03/this-road-is-not-closed-it-is-open-to-all-except-those-in-wide-motor-vehicles/#8d495eb50f95

4 www.theguardian.com/politics/2020/jul/27/cycling-ambitions-for-england-move-up-a-gear-with-no-10-plans

5 www.itv.com/news/2020-07-26/boris-johnson-to-unveil-cycling-prescriptions-and-health-plans-in-obesity-crackdown

6 www.eastyorkshirebuses.co.uk/new-bike-friendly-buses

2 State of the art

This section of the paper examines existing literature to draw out salient insights that help frame Combo Travel and move towards understanding where new opportunities for research and development may lie. Examination of the state of the art is considered under the following themes:

- **Combo Travel components**
- **Opportunities for the taking**
- **Factors affecting Combo Travel**
- **Combo Travel from a travellers' perspective**
- **An evolving picture for Combo Travel**

2.1 Combo Travel components

Human powered modes within Combo Travel can be multiple in both form and function. A range of different motorised modes can accompany the human powered modes, involving public and private transport.

Active modes

As noted in the introduction, 'active travel' first and foremost conjures up walking and cycling as the modes in question. However, in recent years the notion of 'micromobility' has arrived. The ITF defines this as follows. *"Personal transportation using devices and vehicles weighing up to 350 kg and whose power supply, if any, is gradually reduced and cut off at a given speed limit which is no higher than 45 km/h. Micromobility includes the use of exclusively human-powered vehicles, such as bicycles, skates, skateboards and kick-scooters" (*ITF, 2020: 7). As already highlighted in the introduction, individual categories of vehicle in such a definition are made up of a (growing) number of vehicle types – including those designed for mobility impaired individuals (with wheelchairs conspicuous by its absence in the list above).

Active travel and micromobility are not necessarily synonymous since the latter (as defined above) involves devices and vehicles. Walking falls outside of this but so too do running and jogging. Running has received little or no attention by transport practitioners and policymakers, *"being included somewhat unceremoniously as 'other'"* (Cook, 2014: 9). Run commuting refers to running as a mode for getting to/from work (Cook, 2014; Cook, 2019; Winstanley, 2020) and, it is suggested, (without definitive figures being available) has been growing in popularity (Cook, 2019; Winstanley, 2020). Indeed according to the running app Strava[7], year-on-year increases appear substantial, especially for larger urban areas (Cook, 2019). Run commuting can be a door-to-door mode and *yet also* contribute to Combo Travel. As Cook notes: *"[m]any run-commuters run to a train and onwards again after alighting, combining running and rail voluntarily"*. Popular press articles attest to such prospects and the flexibility of run commuting (sometimes choosing between door-to-door and in combination with public transport), as well as offering how-to tips[8].

7 www.strava.com/

8 www.therunnerbeans.com/top-tips-run-commuting
www.runnersworld.com/uk/training/a773800/10-top-tips-for-run-commuting
www.theguardian.com/lifeandstyle/the-running-blog/2013/apr/26/how-start-run-commuting

Owned versus shared

Where active modes involve a vehicle, latterly an important distinction between owning and sharing (hiring) vehicles has emerged. In turn, as app-based access to shared systems has evolved, a distinction between station-based and dockless shared systems has also emerged. *"While in a station-based system users can start or end their trips only at predefined locations, the dockless system allows users to start or end their trips (almost) anywhere in the city"* (Oeschger *et al*., 2020: 2).

Different ends of the journey

As well as different forms of human-powered modes within Combo Travel, different combinations with trunk-leg motorised modes are possible. The most notably distinction is between the active part of the door-to-door journey being the 'last mile' versus being the 'first mile' (Oeschger *et al*., 2020). It could of course be both; and the length of either or both ends could vary in absolute terms and in proportion to the trunk-leg. While most Combo Travel journeys might be assumed to be of the form active+motorised, motorised+active, or active+motorised+active, more elaborate multi-stage journeys can be imagined and different human-powered modes may be used at either end of a journey (or part-way through a journey). POLIS (2019) suggests a greater challenge (in terms of Combo Travel supporting public transport) at the 'home' end of a trip, assuming that the 'destination' end may typically be in compact city centres where the 'last mile' is less challenging.

In relation to walking and public transport, van Soest *et al*. note that *"[m]any studies do not distinguish between the home and activity side, or access and egress trips"* (van Soest *et al*., 2020: 175). In very recent work examining bicycle parking at train stations in the Netherlands, Jonkeren and Kager (2020) considered how second bike ownership featured in Combo Travel, fulfilling the 'last mile' requirement at the alighting station, as distinct from the bike used for the 'first mile' in reaching the boarding station.

Goods movement

First/last mile considerations are significant for movement of goods, especially in an era where online retail is booming and creating substantial new demand for movement of goods to people as opposed to people moving the goods that they have purchased. The EEA (2020) note the transhipment costs that come with trying to fulfil requirements while minimising environmental impact of goods movement. Bruzzone *et al*. elaborate on the evolving challenges for city logistics brought about by e-commerce and changing consumer expectations alongside steps to limit environmental impacts. They suggest that integration between freight and passenger transport *"may be seen as a possible solution for achieving higher efficiency and sustainability"* (Bruzzone *et al*., 2021: 46).

Combo Travel, as understood in this paper, principally lends itself to movement of people and their multimodal experience of door-to-door movement that incorporates a significant level of physical exercise. However, in terms of first/last mile considerations, active travel can also play a part in the movement of goods. Viewed from a physical activity perspective, Combo Travel focuses upon the individual traveller gaining physical exercise from a journey. A door-to-door movement of goods would likely not involve the same individual being responsible for the goods in question moving both by motorised and active modes. This said, if Combo Travel were interpreted more flexibly, the appeal of building exercise into one's daily schedule could include, for example, greater use of local community collection points with active travel between the collection point and the final (household) destination. It might also include couriers (combined) use of active and motorised modes.

2.2 Opportunities for the taking

Combo Travel offers significant appeal from both a transport planning and public health perspective.

The importance of active-motorised interdependence of travel

There is considerable recognition of what can be achieved by the coming together of active modes and public transport modes from the point of view of sustainable mobility and the ability of Combo Travel to boost the viability of using public transport and offer an attractive alternative to door-to-door car travel (Oeschger *et al*. (2020).

The attractiveness of public transport services can quickly diminish beyond the core area or corridor served (Alkhanizi, 2018). Krizek points to the prospect of Combo Travel (in the context of cycling and public transport) leading to increases in *"(a) the catchment area and subsequent patronage of transit, (b) the efficiency of transit by reducing the necessity of feeder bus services, and (c) the overall demand for cycling" (Krizek, 2011: 1). Combo Travel represents "the best of both worlds"* (Jonkeren and Kager, 2020: 3) – seen particularly for train and bicycle in combination. *"Trains are fast and well-suited for long distance travel. Bicycles meanwhile render trains accessible for large groups of travellers"* (Jonkeren and Kager, 2020: 3).

Cycling is seen as particularly significant for the alliance between active and motorised modes, being *"substantially faster than walking and more flexible than public transport [feeder services] due to its 'continuous' character eliminating waiting and scheduling costs"* (Martens, 2007: 327). Indeed, in the Netherlands (where bus journeys can be relatively short), this appeal of cycling as a feeder mode can also be seen as a competitor and threat to bus services (Martens, 2007; Kager *et al*., 2016). Extended catchment areas achieved by cycling can also create *"complex overlaps of catchment areas serviced by multiple stations"* (Kager *et al*., 2016: 212). Catchment areas are particularly significant to public transport if it is to compete with the car when addressing more sparsely distributed services in suburban and rural areas (POLIS, 2019), such that in terms of Combo Travel, first mile may need to extend to first 3-5 miles.

Perhaps significantly, Kager *et al*. consider *"how the combined use of bicycle and train can be understood as a distinctive transport mode having intrinsically different characteristics than the sum of its parts"* (Kager *et al*., 2016: 209). This may be particularly important to developing the concept and application of Combo Travel. There is a need to understand 'whole journey' user perspective. Meanwhile the EEA provides a reminder that, from a user perspective, Combo Travel is only as good as its weakest link: good first/last mile options "cannot compensate for an underdeveloped public transport system" (EEA, 2020: 7).

The positive impacts achievable from Combo Travel

Considerations above centre upon the appeal of Combo Travel from the perspective of transport planning and offering Combo Travel as a distinctive and effective means of travel and one to rival the car. However, there are also important health benefits for the taking. Insufficient physical activity is a significant global problem (Ragaini *et al*. (2020). One source suggests that *"[t]he global pandemic of physical inactivity is responsible for at least $67.5 billion of economic burden per year"* (Laranjo *et al*., 2020: 1). Active travel, even in small measures, could contribute to health improvements (Panter *et al*., 2013), including as a component of longer distance trips involving motorised modes (Rissel *et al*., 2012).

In Sweden, so-called passive commuting has been in decline from 1998 to 2015 with a corresponding increase of 12-19% in moderate/high-dose 'active commuters', and *"[l]ow- and*

moderate/high-dose active commuters had significantly decreased risks for a first time CVD [cardiovascular disease] during follow-up" (Eriksson *et al*., 2020: 370). Drawing upon a randomised trial of women aged 45 and over in the United States and using a sample of over 18,000 participants it was found that *"[m]ore steps taken per day are associated with lower mortality rates until approximately 7500 steps/d"* (Lee *et al*., 2019: 1106). Increases in exercise that can improve health are there for the taking with Combo Travel, albeit that few studies appear as yet to focus upon such impacts. Panter *et al*. (2013) in considering the incorporation of walking or cycling into car commutes in Cambridge, UK, revealed averages of 12 and 17 minutes per day of walking and cycling respectively and suggested that *"[u]nderstanding the reasons for engaging in such behaviours may therefore have important implications for population physical activity promotion"* (Panter *et al*., 2013: 216). Rissel at al. (2012) suggest that in the US nearly 30% of people who use public transport are getting around half an hour of exercise per day just from walking to/from stops.

Getting to the essence of Combo Travel, Ragaini *et al*. (2020) examined the behaviour of people walking to more distant bus stops in Tasmania, Australia and, with regard to the qualitative research element (22 interviews), participants from Hobart. They point to health promotion messages that encourage a practice of Combo Travel to ass *"add minutes of incidental physical activity"* (Ragaini *et al*., 2020: 2). Of survey respondents who had used the bus in the previous week, 13% had walked to a more distant bus stop (every time or most times). Notwithstanding the small interview sample, over half of interviewees had walked to a more distant bus stop, and of these over half had done so for physical activity gain. Yet it was also observed that *"many interviewees overlooked the physical activity benefit of this behaviour"* (Ragaini *et al*., 2020: 1) with a *"lack of awareness of the health benefits of accumulating small amounts of physical activity"* revealed (Ragaini *et al*., 2020: 4).

Of potential significance to encouraging increased exercise (and awareness raising of health benefits) could be the availability of apps to monitor people's step counts. Laranjo *et al*. in their meta-analysis of physical activity trackers determined that *"[i]nterventions using smartphone apps or activity trackers seem promising from a clinical and public health perspective, promoting a significant step count increase of 1850 steps/day"* (Laranjo *et al*., 2020: 10). They point also to the role of such trackers in offering benefits to those who are not *"the 'worried well'*[9] *early adopters"* (Laranjo *et al*., 2020: 10).

Several studies highlight the multiple benefits of Combo Travel including, but not exclusive to, health (Krizek, 2011; Jonkeren *et al*. 2020; Oeschger *et al*., 2020) including environmental improvements and congestion reduction. Jonkeren *et al*. (2020), in relation to micromobility, list multiple impacts including prospects for improved accessibility, social inclusion, liveability of the built environment, and local economic benefit. Concerns are being raised about the possibility that micromobility could potentially have adverse health effects depending upon whether its use replaces motorised trips or walking or cycling trips where more physical effort is expended (POLIS, 2019; EEA, 2020). While potential impacts are being recognised, there is a paucity of attempts to empirically examine such impacts (Oeschger *et al*., 2020).

2.3 Factors affecting Combo Travel

There are multiple factors that can influence individuals' propensity to combine active travel with motorised travel for their journeys.

9 https://en.wikipedia.org/wiki/Worried_well_(medicine)#:~:text=The%20worried%20well%20is%20a,based%20on%20a%20current%20circumstance

Walking access to public transport

Factors influencing walking related to public transport are examined by van Soest *et al*. (2020) who distinguish between personal, public transport related, environmental, and journey related factors (see also Venter, 2020). Their paper is especially concerned with how far people walk. Walkability of the built environment is, not surprisingly, highlighted (as previously noted by Rissel *et al*. (2012)). Venter (2020) in examining first/last mile issues in South Africa further notes how this can vary between locations, notably between central urban areas and more peripheral areas. In examining walking to a more distant bus stop in an Australian study, Ragaini *et al*. (2020) suggest a knowledge gap in understanding the determinants of this behaviour. However, from their limited qualitative insights, reasons for not partaking of this behaviour include *"time constraints, injury, traffic, pollution and unfamiliarity with other bus routes or timetables"* (Ragaini *et al*., 2020: 4). There was also an indication from some study participants that *"walking further was unnecessary because they were already doing sufficient physical activity"* (Ragaini *et al*., 2020: 4). Crime is another factor (Venter, 2020) and not one that is well researched (van Soest *et al*., 2020).

It is suggested by van Soest *et al*. (2020) that international practice in public transport planning frequently takes willingness to walk distances to be 400m for buses and 800m for trains (Kager *et al*. (2016) similarly suggest a walkable distance of 1km (10 minutes) as defining the catchment areas for a train station). However, it is not clear how such willingness to walk is affected by the conscious wish to partake of (more) physical activity that is reflected in the Combo Travel concept. There is variability in how far individuals walk to or from public transport which can in part relate to whether choice or necessity dictates behaviour; and longer distance can be associated with areas with higher car ownership and (in turn) which are less well served by public transport leading to longer distances to reach such services (van Soest *et al*., 2020).

Cycling access to public transport

Cheng and Liu (2012) set out multiple determinants of (perceived) intermodal inconvenience for Combo Travel involving cycling and public transport (where a person's own bike accompanies them for the whole journey). These included regulations for cycles associated with public transport, bicycle journey navigation, built environment quality of cycle route, and ease of handling and storing the bicycle in the public transport environment. More broadly for micromobility, Oescher *et al*. (2020) also note the significance of the built environment around public stations, while La Paix *et al*. (2020) consider perceptions of cycle infrastructure and the impact on choosing bicycle access to train stations in the Netherlands.

As seen above, cycling offers extended catchments surrounding stations and stops compared to walking and, as noted earlier, such catchments can overlap such that cycling competes with public transport feeder services and can create *"complex overlaps of catchment areas serviced by multiple stations depending on, amongst others, final destination station, departure time, cycling speed, preference for the station or its surrounding amenities, the option of intermediate destinations, train characteristics or expectations of any of these aspects for the return trip"* (Kager *et al*., 2016: 212).

Active travel combined with car travel

Perhaps understandably from a transport planning perspective, less literature is available concerning combining active travel with car travel. One such example is by Panter *et al*. (2013) focused upon healthy adults' commuting in Cambridge, UK. Greater likelihood of incorporating walking or cycling into a car commute is associated with: (i) lack of access to, or having to pay for, parking at work; and (ii) more supportive active travel environments. While less research appears to have been undertaken into active travel combined with car travel, this behaviour may be of greater significance to Combo Travel where improved health of the individual is the motive and with the prospect of some reduction

in length of car stages of journeys, notwithstanding potential unintended consequences such as car+walk/cycle trips replacing public transport-based trips.

Supply-side issues

Particularly in relation to bicycle and public transport integration there are supply-side issues that have been considered over several years. Examination of developments in North America (Pucher and Buehler, 2009) highlighted five measures to promote integration: provision of parking at stops/stations; multi-function bicycle stations, bicycle racks on buses, bicycles on board vehicles, and cycle routes to/from stops/stations. Empirical analysis by Krizek (2011) in the United States found a descending order of preference for integrating cycling with public transport: (i) taking the bicycle on the public transport vehicle; (ii) taking the bicycle to the stop (and parking it there); (iii) using a shared bicycle; and (iv) using two bicycles owned by the individual at either end of the public transport journey. Popularity of taking one's own bicycle on the public transport vehicle can be in conflict with carry capacity, especially at peak times (Pucher and Buehler, 2009). Cycle storage at train stations has become a particular challenge in the Netherlands, due in part to people having a separate owned bicycle for either end of the train journey. Jonkeren and Kager (2020) highlight the inefficiency of this, particularly in terms of the bicycle at the remote end of the journey that can be left unused for greater periods of time. They suggest four policy options to address bicycle parking at stations: (i) attempting to ban second bicycle storage close to train platforms; (ii) locating designated second bicycle storage more remotely; (iii) offering more shared bicycles; and (iv) an awareness and warning campaign.

2.4 Combo Travel from a travellers' perspective

Users are of course at the heart of understanding travel behaviour, in terms of their characteristics, attitudes and preferences and how they make sense of, and choose between, the travel options available and with what informational assistance.

Heterogeneity of travellers

Sections above demonstrate the multi-facted nature of Combo Travel and influencing factors. Further still is a need to recognise the diversity of types of people, their circumstances, attitudes and preferences that make up the travelling public. Such considerations are pertinent to wider understandings of travel behaviour and are likewise relevant to Combo Travel. Oeschger *et al*. (2020) provide an up-to-date systematic literature review of micromobility and public transport integration, including consideration of the following user characteristics across the literature: socio-demographic attributes; preferences; reasons for modal choice; mobility patterns; and perception and acceptance of micromobility services. A substantial proportion of the studies reviewed are survey-based and/or modelling studies (Oeschger *et al*., 2020: Table 7) suggesting a relative paucity of more detailed in-depth qualitative studies to understand the relationship between transport users (and their life contexts) and the prospects of Combo Travel.

Hickman and Vecia (2016) examined last-mile issues for commuters in Ealing, London. Using Q methodology, four traveller 'discourses' are developed based upon participants' assessment of a series of 44 statements about the commute journey (Hickman and Vecia, 2016: Table 6), the discourses being: 'the public transport user'; 'the committed cyclist'; 'the multi-modal traveller'; and 'the frustrated traveller'. The absence of a pro-car discourse may be explained by the urban setting for the empirical work. Shergold and Lyons (2013), report on a project that developed a door-to-door journey planner for trips that involve use of car and train. While not addressing active travel, it considered scenarios where individuals may not drive to their nearest departing station but instead travel further in order to connect with different rail services in the interest of a better overall journey. This has parallels with Combo Travel in terms changing the overall modal proportions of a journey. The empirical research developed an illustrative classification of traveller types: 'determined car

drivers'; 'local station train lovers'; 'evolutionary explorers' (who developed a mental map of road-rail options for their long distance journeys); 'habitualised innovators' (who come to have what they see as 'normal' non-local station access road-rail journeys); and 'unsuspecting habituals' (who can be nudged into considering new travel options).

Ji *et al*. (2017) in examining bicycle and rail Combo Travel in China provide an important reminder of the need to be aware of equity issues when examining, developing and promoting travel options. Results in this study showed that *"female, older, and low-income rail commuters are less likely to use public bicycle to access rail transit"* (Ji *et al*., 2017: 308; see also van Soest *et al*., 2020).

There is a more widely applicable data gap when it comes to understanding and representing diversity in the transport system and profession (including, but not limited to, ethnicity and gender)[10] and this will almost certainly be true of Combo Travel.

Informational influence

There is clearly a role for information provision supporting Combo Travel. The example of the road-rail journey planner above points to potentially new requirements for Combo Travel (whether or not within a Mobility as a Service setting) in terms of enabling individuals to conveniently plan multi-modal journeys with an express interest in factoring in the amount of exercise required from the journey. POLIS (2019) highlights the potential conflicting objectives between information/mobility service providers, transport authorities and users in relation to information provided and how it is used. Yet co-operation is needed between these different actors, especially in a context where first/last mile (or longer) shared modes (docked or dockless) are involved (Oeschger *et al*., 2020). As touched upon earlier, information provision may also be significant for Combo Travel in terms of activity trackers (where drop-off rates in use can be high) (Laranjo *et al*., 2020). It may indeed be the case that journey planners that allow individuals to stipulate the number of steps they wish to introduce into their Combo Travel would appeal.

2.5 An evolving picture for Combo Travel

It is notable that of the literature examined in this paper, around half of the articles have been published in the last year (and nearly all within the last decade). Combining active and motorised modes is a contemporary, and in some respects nascent, research topic, reflective of change taking place within the transport system itself in different countries. It is also notable that almost none of the research examined specifically concerns the UK.

Innovation and its diffusion

Active travel's place in the mobility system and in terms of significance to Combo Travel has evolved considerably over time. Enabled by policy interest in realising benefits including public health improvements, the Netherlands is no stranger to the integration of bicycle and rail travel, with bicycle parking at stations having been available for decades (Martens, 2017), leading to a growing share of first/last mile use of bicycles for rail journeys (allied to increasing rail travel) (Jonkeren and Kager, 2020). Meanwhile in the US, *"the percentage of buses with bike racks almost tripled in the U.S. in only eight years, from 27 percent in 2000 to 71 per cent in 2008"* (Pucher and Buehler, 2009: 82). POLIS (2019) refers to the 'waves' of micromobility, marking its dramatic changes over time. In the first wave, walking and cycling constituted micromobility and struggled in the face of the car-dominated mobility paradigm. The second wave saw the arrival of shared bicycles, thanks to digital connectivity and the app-era (including docked and dockless). The third wave we are currently experiencing has

10 www.linkedin.com/posts/glenn-lyons_the-chance-for-a-more-inclusive-new-normal-activity-6790161723111415808-9pJ2

two further significant differences: it is no longer just about bicycles and many of the fleets of shared vehicles are electric. The extent of diffusion of innovation is remarkable. *"Recent data on conventional bike and/or electric bike (e-bike) sharing systems reveal that more than 2900 systems are operating in cities worldwide"* (Galatouloas *et al*., 2020: 1). This compares to 17 bicycle sharing systems worldwide in 2015 (Oeschger *et al*., 2020). Such developments have been *"[s]upported by technological advances over the years, including mobile technology, electronic payment and GPS-enabled devices"* and *"have been overcoming many operational challenges to provide fully automated, secure and cost-effective systems"* (Galatouloas *et al*., 2020: 1). Yet only 10 years ago Krizek (2011), in relation to capacity constraint problems with bicycle-transit integration focused upon bicycles being taken on board, suggested that *"the opportunity is ripe to consider broader solutions – about which there is a dearth of information"* (Krizek, 2011: 1). Mobility times are changing when it comes to Combo Travel.

The state of studying the state of the art

It is instructive to illustrate the state of the art by reference to assertions from some of the papers' authors, as shown in Table 1. Broadly speaking, walking and cycling in combination with public transport use have been considered for some time. However, understanding of the phenomenon of travelling to more distant stations/stops is nascent. The more recent explosion of micromobility in its different forms (including owned/shared and docked/dockless forms) is in turn starting to be given more attention. It is notable from the Oeschger *et al*. (2020) review of micromobility how many studies are associated with China for shared micro-vehicles yet none (in the review) are associated with China for private micro-vehicles. There are differences in developments and research attention internationally, allied to different institutional and cultural contexts.

Table 1. Indications of the emergent state of Combo Travel as a topic of research attention.

Publication	Combo Travel focus	Quote (page number)
Panter et al. (2013)	Active travel and car integration for commuting	"As far as we are aware, this is one of the first studies to explore why car commuters integrate walking and cycling into their journeys" (216)
Heinen and Bohte (2014)	Bicycle and public transport commuting	"Even though both bicycle and public transport often are used in a single trip, this combination has gained limited attention in academic research thus far" (111)
Ji et al. (2017)	Shared bicycle and rail	"the primary focus of existing bicycle-transit integration research has been on the use of private bicycle and its integration with buses with limited focus on rail transit and public bicycle" (309)
Van Soest et al. (2020)	Walking and public transport	"A significant body of research, especially over the last decade, has been developed which provides more insights into public transport-related walking" (161)
Ragaini et al. (2020)	Walking to more distant bus stops	"To the authors' best knowledge, this is the first study to investigate this specific aspect of active transport behaviour" (2)
Venter (2020)	First-last mile connection to public transport	"While individual modes used during the first/last mile (1LM) trip, such as walking and feeder buses, have been widely studied, the multimodal and diverse nature of the 1LM environment is rarely dealt with" (1)
Oeschger et al. (2020)	Micromobility and public transport integration	"This paper presents an extensive systematic literature review of studies that focus specifically on the integration of micromobility and public transport systems and is, to the knowledge of the authors, the first review focusing on this specific aspect of micromobility." (1)

Knowledge gaps

As is the convention in academic work, there is ever an eye to the areas meriting further research. This is evidently the case when it comes to Combo Travel. Ragaini *et al*. (2020) point to better understanding being needed of people choosing to walk to more distant bus stops. Physical activity trackers are a nascent phenomenon of some significance yet long term effectiveness and issues of sustained engagement need addressing, and with more diverse populations (Laranjo *et al*., 2020). Kager *et al*. (2016) more broadly emphasise the importance of giving Combo Travel the sort of behavioural research attention that 'traditional' modes have been subject to. There is also a need to recognise that behavioural insights for door-to-door active travel may not necessarily be transferable to Combo Travel (Venter, 2020). Oeschger et al. suggest more needs to be understood regarding the impacts of integrating micromobility with public transport and the *"practices and mobility patterns of micromobility and public transport users"* (Oeschger et a*l., 20*20: 18). While such insights are illustrative of knowledge gaps, there is an overall sense from the literature that it is an important period of time ahead for giving much greater attention to Combo Travel in an environment where developments in practice have been changing significantly and where unrealised potential for further change exist, particularly if supported by research and innovation efforts.

2.6 Summary

Drawing upon the review above, the following summary points can be made:

- Combining active travel with motorised travel is not a new phenomenon, though it has been evolving significantly in terms of form and function.
- Interest in such travel has been from two perspectives: transport planning; and public health. The former has, it would appear, received more attention, whereas the latter is more pertinent to Combo Travel as of particular interest in this paper.
- There is little if any overlap as yet between research into personal activity trackers and into Combo Travel and yet the two could come together in an important way.
- Goods movement is not considered in depth in the review. Combo Travel could be seen to be primarily focused upon an individual's door-to-door journey experience, involving physical activity combined with motorised travel. However, if treated more broadly regarding building exercise into people's daily schedules then scope for inclusion of goods movement in Combo Travel becomes apparent.
- Multiple means of human powered mobility (with or without vehicles) are now available, though in terms of Combo Travel, research attention has especially focused upon walking and cycling. Broader micromobility is a more recent phenomenon, running has seen very little attention, and modal forms associated with mobility impairment are conspicuous by their absence in the research examined.
- Context matters when it comes to considering Combo Travel and this involves a multitude of factors relating to modes, ownership versus usership, different ends of a motorised journey, built environment characteristics, and especially user characteristics (including but not limited to ethnicity and diversity).
- Combo Travel must be understood as more than the sum of active and motorised travel. It should be considered as a 'mode' in its own right and with a whole journey experience and perspective in mind.
- Catchment area around public transport stations and stops is an important consideration for Combo Travel and can be seen as something that could become extensible if Combo Travel includes the encouragement of conscious extension of the active travel leg(s) of a journey.

- If an active travel vehicle is involved in Combo Travel then there are significant practicalities to consider from both a transport operator and user perspective. The 'third wave' of micromobility with emphasis on shared rather than owned resources is an important development in this regard.
- While Combo Travel in relation to public transport being combined with active travel is a natural priority for attention in related literature, combining active travel with car use should also be considered, given the prospects for improving health and affecting the nature and extent of car traffic.
- Information provision is a key aspect of Combo Travel. There may be bespoke journey planning requirements that include choice over the relative proportions of active and motorised travel in planned journeys and the possibility of stipulating the number of steps sought from a Combo Travel journey.
- There appears to be more insight concerning the behaviours associated with Combo Travel than regarding the (health) impacts arising from Combo Travel.
- There remains a need to get to the heart of the user perspective in relation to Combo Travel and in turn to consider some rebalancing between a predominant focus on surveys and modelling, and opportunities for more in-depth qualitative research.

3 Timeliness, developments and possibilities

Building upon the examination of literature above, initial view and insights about Combo Travel were also gathered from a variety of stakeholders via an online round table discussion and one-to-one interviews. Stakeholder coverage included: place-leaders from local authorities, Combined Authorities and Transport Authorities; strategic bodies responsible for improving health and wellbeing outcomes through increased physical activity; a broad range of supply-side innovators – from bus and train companies to the developers of apps and digital solutions; strategic planning, design and engineering consulting businesses; and specialist active travel advisory organisations as well as cargo bike and e-bike firms. A full list of the interviewees and round table participants is included in the Appendix.

To frame this engagement, three questions were used:

1. What are some particularly timely opportunities or developments for Combo Travel as you see them?
2. What questions, research or innovation gaps might you like to see explored in relation to Combo Travel?
3. What problem to do with a Combo Travel trip do you wish someone else would solve for you?

From the discussions that these questions prompted, a series of insights were identified that have been organised below thematically.

3.1 Emergent themes

Insights below are set out under seven themes:

- User needs
- Rethinking public sector funding
- Safety and security
- Information
- Spatial characteristics
- Carrots and sticks
- Accessibility and inclusion

The themes encompass nuanced perspectives of diverse experts on the nascent topic of Combo Travel, and on how – through understanding triggers for, or barriers to Combo Travel – innovation might be unlocked that can help grow the provision and demand for Combo Travel.

Under each theme we have chosen to contrast the narrative style above in examining existing literature by directly sharing a series of extracts (without attribution) from the discussions with stakeholders. The extracts are close to verbatim but with some editorial changes, where appropriate, to help communicate the points when taken out of the context of the discussion flow itself. The intention is that such extracts can act as triggers for, or resonate with, others' thinking.

User needs

User needs relate to considering the requirements that add value to a product, service or environment for different Combo Travel users. Key points made included the following:

- "Combo Travel does inherently require access to different types of travel. We need to think about *ability, wellness, safety*. We will get the most impact by broadening the top of the funnel and focusing on inequality."
- "How to support entrepreneurs at the earliest possible point to really understand the *lives of people who are least active* – rather than retrofitting the product behind the narrative. Tough to monetise and generate revenue out of it but also vital at the societal level and in reducing costs..."
- "Where are the *real pain points*? We need to be gathering data by doing – ensuring we are monitoring and evaluating innovations and existing interventions – rather than only starting new research projects."
- "Generally the focus seems to be towards earlier adopters who tend to be more *affluent* - how to flip that so early adopters are *those people most likely to benefit in addressing social and health inequalities* – otherwise the process could ingrain inequality further. For example, folding e-bikes are expensive (even if cheaper than a car). Are there good old days to return to – was Combo Travel alive and well before Beeching? – are there lessons to take from the past to put into a modern context?"
- "Why don't people *value active travel*? We seemingly go great lengths to avoid it - such as parking closest to the supermarket entrance!"
- "For Combo Travel, it'll be important to segment the audience in a good way and see where the opportunity lies."
- "Might we distinguish between barriers to active travel in general, and those concerning Combo Travel in particular? How can we focus our efforts and innovations?

These points underline the importance of understanding the makeup, circumstances and motivations of people who do or could practice Combo Travel. This cannot be superficially treated if true innovation in support of Combo Travel is to flourish. Combo Travel, like all travel, is not a behaviour that takes place in a vacuum according to the logic of homo economicus. It forms, or could form, part of people's everyday lives in which ability, means, hopes and inhibitions are at play. Diverse characteristics and experiences in what is an environment of inequality when it comes to travel, will result in a range of different requirements from and reactions to Combo Travel. This needs to be carefully examined, reaching beyond only presumption of understanding.

Rethinking public sector funding

Active travel and Combo Travel impacts can be considered in terms of mental and physical health, reduced road deaths, placemaking, air quality, carbon reduction and more; but do existing public sector funding approaches offer sufficient scope for Combo Travel playing a part in addressing such a range of policy issues? Key points made included the following:

- "There's an *epidemic of inactivity in the country*. Is there a partnership with the NHS here? One of the biggest barriers to activity is time - people who are time poor. Is there a change in wayfinding service that could say 'here are my typical journeys and pattern of activities'? Envisage 'the activity consultant' which says how to incorporate the 130 minutes of activity each week into your life by changing some journeys – with Combo Travel being a really key part of this. How do you incorporate other factors – time saved, money saved, calories burnt?"

- "Take the Levelling Up agenda – for example. In the Towns Fund bids there is a lot on *Active Travel and public realm improvements, but very little on knitting this together with service provision* and the idea of Combo Travel."
- "Is there opportunity for a *collaborative approach between transport and micro-mobility operators* to jointly lobby Local Authorities to use funds like the Emergency Active Travel Fund to pay for mobility hubs and parklets that benefit multimodal travel?"
- "How might we encourage and enable people to use *active travel on holiday as a way into using it more in day-to-day life*, which seems like a good way to reach beyond the core enthusiasts."
- "CentreParcs has been doing wonders on this front for ages. Yet people don't seem to tie in their holidays being nice due to safe streets that aren't full of cars, and to consider that it's also viable day-to-day where they live."
- "Government funding tends to come for building stuff (infrastructure) – very little OPEX funding. Need to build infrastructure, run services, do the campaigns, provide incentives, then evaluate. Too much focus on CAPEX. How we fund innovation to embed in businesses needs to adapt and change."
- "Town deals were focussed on infrastructure and didn't leave much funding for revenue initiatives, such as changing behaviour or services."

Such insights begin to point towards opportunities to think more creatively about how public sector funding is made available and what scopes are defined for use of funding that can help unlock innovations of relevance to Combo Travel.

Safety and security

Safety and security concern a need to reduce and prevent risks and accidents as well as prevent, or reduce the likelihood of, any intentionally malicious activities in relation to Combo Travel. Key points made included the following:

- "Bike theft is a big issue."
- "The perception that an electric bike will get stolen is a known barrier to purchase."
- "Safety is a key concern for women in active travel as a mode."
- "Many women don't feel comfortable taking public transport or walking alone after a night out. Cycling can play a part here. Sometimes, I know friends who will Uber with a bike to where they are going - so as not to ruin their outfit – who are then able to cycle home afterward. But its no good if safety and security concerns are too great."
- "A lot of people are inactive because opportunities have been taken away from them and they are so inured against it that they don't even have in their consciousness that the alternatives are there. Its when they go to Center Parcs or similar, that they change their mindset and go 'wow' I can do this, in part because its a nice, safe, traffic free route…"
- "Safety in this sense being personal safety in the environment as well as accident safety i.e. helmets."

Since the stakeholder engagement exercise, the appalling and tragic death of Sarah Everard took place. She went missing after leaving a friend's house near Clapham Common in London to walk home. Her death provoked protest about a society in which women do not feel safe, and may not be safe, alone outdoors. The travel environment can be both perceived to be and in some cases found to be unsafe. This may not be apparent from a white, male perspective but over half the travelling public are not white men. For Combo Travel to be made more attractive, diverse experiences of, and concerns regarding, the travel environment (at different times and places and for different types of people) need to be better understood.

Information

Information addresses the need to enable different users to access content that enables Combo Travel trips. Key points made included the following:

- "Wayfinding – major platforms not plugged into cycling and walking or Combo Travel (and are all roads based). A 'smart conversation' with the right tech companies, or the right innovation challenge, could promote a big step change here."
- "Not even knowing ahead of a journey whether you can or can't put a bike on a train. Or if so at what time/s restrictions might apply or be relaxed again."
- "In terms of commuting – journeys which are too long to undertake by active travel only but journeys either side of that which could be. We could be upping our game in terms of active travel route finding to stations and storage. Design assuming journeys either side will be active…"
- "How can we get correct, useful and timely information out to people who aren't currently travelling to stations?"

Information can be both an enabler of or barrier to Combo Travel. Propensity to engage in Combo Travel may not be influenced (primarily) by information. Willingness to consider Combo Travel is likely to come from personal motivation, perceived behavioural control ("I think I could do this"), and wider awareness of the conditions for Combo Travel being, or having become, more appropriate and the practice of Combo Travel more normalised. However, information can either then support or be an obstacle to behavioural intention translating into behaviour change. Current availability of information has not consciously been geared towards support of Combo Travel specifically. Information needs pertinent to Combo Travel need exploring and information gaps need to be identified and addressed.

Spatial characteristics

Spatial characteristics as a theme encompasses considering different spatial archetypes and their relationship to Combo Travel, including transport interchanges as well rural, suburban and urban contexts. Key points made included the following:

- "Look at the different spatial scales. Take petrol station forecourts, for example. Their days are numbered. They make the money from shops not the fuel. Looking at ways to innovate – most people can get to a garage. It passes the flip-flop test – e.g. to get to click and collect location. Could you take your bike there, leave in locker, grab a coffee – go to work – come back, get bike, pick up your shopping?"
- "I'm really keen to see if we can't push some of this in a rural context too, actually – tying into that levelling up agenda. If you can make mobility hubs at village rail stations or village high streets for bus services, combining in a car club vehicle, personal bike parking, etc. Thinking about active travel to/from that hub and how we can improve it, to enable much more car-free living across the country, rather than just in cities with dense PT Networks (so Glasgow, Manchester, London)."
- "What about mobility hubs? – would someone leave their car at home if they knew they had options?"
- "The big thing is weather – not wanting to stand in the rain. Bus stops that protect from the elements is hard yards to fund – especially in rural areas."
- "One of the areas I was thinking was around rural communities but from more of a service angle – how do you join up networks of villages which don't have services to those that do which could include a mobility hub using a combination of ebikes, upgraded bridleways to take bikes off road and better public transport?"
- "What if the majority of bus and train companies could accommodate bicycles themselves on the vehicles without being a folder or travelling outside of rush-hour? Does the pandemic provide a moment to trial this at a greater scale?"

- "If rebalancing away from 5-days in the office then we'll see a lessening on peak loads. Can we look holistically therefore as this will free up space for bikes on trains or more flexible use if operating at 60-70% of pre-COVID loads."
- "Consider the station 'gateway' and arrival experience. What more can be done to make those who actively travel feel more like a valued customer, rather than an inconvenience? On the whole the safety and convenience to/from these places is designed around arriving or departing by car – not least in terms of parking provision etc. Active travel now is more of a second-class experience."
- "Could we have better options beyond utility transport? Not just for travel purposes but for semi-leisure – if I want to get out a bit further to an attractive location for a bike ride – are there options to do that? Again, could we be encouraged, not just permitted, to get bikes on buses and trains and other modes?"

The points above highlight a need to recognise diversity of context spatially (and temporally) in terms of where, when and how forms of Combo Travel could become manifest. This is about identifying use cases for Combo Travel but also looking more closely at the spatial characteristics concerned that relate to design of facilities and services for such use cases being made attractive and well-used.

Carrots and sticks

What role might targets, incentives and disincentives have in supporting Combo Travel? Key points made included the following:

- "With Tesla paying employees not to drive and park – how can businesses, as well as authorities, incentivise people not to bring their cars at least not all the way into urban spaces?"
- "What about the school run – how can we encourage active behaviours for all or part of the journey? People fight to park on the 'school road' at the moment"
- "How can we reduce or remove the requirement to take 'stuff', not least when travelling as a family/ with children?"
- "What of the sunk cost fallacy? I've paid to go as far as station X – why would I get off earlier at station Y?"

This short list of points alone both further highlights use cases and contexts for Combo Travel but also the importance of, and opportunity to, introduce measures that can influence behaviour which in turn may become normalised. Carrots are more palatable than sticks for the end user but may be less effective and need to be paid for. Sticks may be more effective, but are less palatable. Travel demand management is no stranger to the role of, and complex issues concerning, carrots and sticks. However, Combo Travel presents a unique perspective in which the change being encouraged may not be an absolute switch from one more to another but is rather a modification to a journey. Such a modification is motivated primarily by health benefits. Whether measures take the form of carrots or sticks, individuals whose behaviour is changed to include more active travel stand to gain in health terms at least.

Accessibility and inclusion

Matters of accessibility and inclusion have arisen within the preceding themes. This theme could and should nevertheless have received more attention and, in retrospect, might have been included as a fourth key question for prompting discussion. Further relevant points that were raised included:

- "Sustrans research shows that just 7% of people with disabilities cycle, yet 33% would like to do so. This is about opening up the *freedom and wellbeing benefits of active travel to all*, not just the fit, brave and most able."

- “For riders of non standard cycles there are real barriers in terms of accessibility, which deter not just those with disabilities but also parents riding their children in cargo bikes and sustainable freight and last mile deliveries.”
- “Despite its potential as a more just and equitable mode of transport, everyday cycling – and the image of the typical cyclist – continues to be largely white, male and professional.”

It is worth a reminder that as of the 2011 Census for England and Wales, 51% of the population were female and 14% (nearly 8 million people) were not white. We have a gender and ethnicity data gap in society, including in transport. Combo Travel cannot be seen only through the eyes of physically fit, mobile, well-educated white, male knowledge workers. It must recognise the true diversity of the population and people’s associated circumstances. Granularity of diversity is also important when considering Combo Travel – individual’s are not only defined by their gender or by their ethnicity or by their financial means, or by their level of education, or by their household circumstances, or by … It is the coming together of all of these for each individual that significantly determines their needs from, and experience of, the transport system and in this case Combo Travel.

4 Conclusions and looking ahead

The purpose of this paper is to bring to light a better understanding and examination of the concept of Combo Travel: human-powered mobility in combination with a motorised mode as an enabler of healthier lifestyles and lower carbon journeys. By opening-up the concept, the purpose is also to better appreciate where opportunities for innovation may lie, informed by an awareness of knowledge gaps.

There is a need to distinguish between unlocking innovations regarding active travel in general and Combo Travel in particular. At the same time, both are under-explored in terms of research and development relative to the attention given to other topics, despite their increased and growing profile in government policy, not least transport and health. With policy priorities giving rise to greater investment in active travel, the distinction between different ways in which active travel does or could feature in the mobility system deserves attention. It would be helpful to better understand the investment landscape for research and development relating to active travel. If we are to see barriers and enablers to Combo Travel addressed then strategic innovation bodies will need to act in a co-ordinated way to not only prioritise attention on active travel but to make distinct the place of Combo Travel within this. The paper reveals, both from the literature review and stakeholder engagement, several areas deserving of attention which can help inform and frame future efforts to bring forward innovation.

While this final section of the paper does not set out to list specific recommendations it is appropriate to emphasise the importance of understanding diverse user needs and travel behaviours as a precursor to efforts to develop new interventions, products and services to support Combo Travel. Better appreciating the problems faced and opportunities to be seized should inform pursuit of innovation. There is a role within this for (further) evaluation of active travel interventions that have been taking place to identify the nature and extent of existing signs of Combo Travel or signs of its potential. Qualitative research (including ethnographic methods) should play an important part in developing context-specific understanding of people's everyday lives and what the perceived and real barriers and enablers to Combo Travel are. Consideration of Combo Travel, as touched upon in the paper, does not preclude an association with the movement of goods. Particularly given the trend (amplified by the pandemic) of online retail and its consequences for people's activity patterns and types of demand on the transport system, goods movement should be more than just an afterthought in addressing Combo Travel. Indeed, cargo bikes have grown in prominence, as have goods deliveries by multiple (active) modes. Cargo bikes used in combination with larger motorised vehicles to drop off/and pick up via consolidation and micro consolidation centres is central to several car-free and car-light visions for places such as London, Paris and New York, as advocated by, for example, Possible and the Active Travel Academy[11].

As defined, Combo Travel has in scope use of the car in combination with human powered mobility. In a society still dominated by car dependence, this is important. Imagine for a moment if a (growing) proportion of journeys by car had longer start and end legs involving active travel in the interests of building more physical exercise into people's days. This could improve public health as well as creating opportunities to rethinking where and how vehicles are parked and in turn the design of the build environment. There is much that could be explored here. Part of this should include being alert to rebound effects: there could be perverse outcomes such as strengthening car dependence at the expense of other behaviour changes.

11 https://www.wearepossible.org/carfreecities

It is important that Combo Travel is distinguished from how human powered mobility is, or has been, conceived of in relation to Mobility as a Service (MaaS). Where it concerns the private-sector (leading), MaaS is oriented towards selling mobility within which any role of human powered mobility is a means to that end. This is not to suggest that Combo Travel could not find a place within MaaS. Indeed, viewing MaaS differently through a Combo Travel lens could itself lead to innovations that both enhance MaaS and the attractiveness of Combo Travel.

This leads us to the final point of the paper: the exciting prospect that Combo Travel if properly understood and actively enabled, shows potential to be a super-policy. These are *"policies that achieve positive outcomes across a wide range of areas beyond that which was the primary intention, and which do not have unintended negative outcomes."*[12] As an under-explored and under-developed phenomenon, Combo Travel could play its part in supporting public health, supporting motorised transport services, supporting transport decarbonisation and promoting economic prosperity. On this basis, Combo Travel would seem deserving of further attention.

12 Superpolicies and policy-omnishambles, McCartney, 2020.

5 References

Alkhanizi, J. (2018). Enabling first and last mile travel solutions. *Proc. Annual Transport Practitioners Meeting*, 5-6 July, Oxford.

Bruzzone, F., Cavallaro, F. and Nocera, S. (2021). The integration of passenger and freight transport for first-last mile operations. *Transport Policy*, 100, 31-48. https://doi.org/10.1016/j.tranpol.2020.10.009

Cheng, Y-H. and Liu, K-C. (2012). Evaluating bicycle-transit users' perceptions of intermodal inconvenience. *Transportation Research A: Policy and Practice*, 46, 1690–1706. http://dx.doi.org/10.1016/j.tra.2012.10.013

Cain, S., Martin, A. and Andersen, M. (2019). *The First and Last Mile. Changing the Dynamic of Everyday Journeys*

https://static1.squarespace.com/static/5ba9f9fa29f2cc21be0f3457/t/5c34b809cd83666439180965/1546958871691/GoAhead_FirstAndLastMile.pdf

Cook, S. (2014). *Running as Transport*. MA thesis, Royal Holloway. http://owncloud.forumviesmobiles.org/index.php/s/VsVGbQu8DNk4wGf

Cook, S. (2019). *The rise of run commuting*. Forum Vies Mobiles, 7 February. https://en.forumviesmobiles.org/printpdf/12855

DfT (2020a). *Gear change: a bold vision for cycling and walking*. Department for Transport, July. https://www.gov.uk/government/publications/cycling-and-walking-plan-for-england

DfT (2020b). *Decarbonising Transport: Setting the Challenge.* Department for Transport, March. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/876251/decarbonising-transport-setting-the-challenge.pdf

DfT (2021). *Bus Back Better – National Bus Strategy for England.* Department for Transport, March. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/969205/DfT-Bus-Back-Better-national-bus-strategy-for-England.pdf

DHSC (2020). Tackling obesity: empowering adults and children to live healthier lives. Policy paper, Department of Health & Social Care, July. https://www.gov.uk/government/publications/tackling-obesity-government-strategy/tackling-obesity-empowering-adults-and-children-to-live-healthier-lives

EEA (2020). *The first and last mile — the key to sustainable urban transport Transport and environment report 2019.* European Environment Agency. https://www.eea.europa.eu/publications/the-first-and-last-mile/at_download/file

Eriksson, J.S. et al. (2020). Active commuting in Swedish workers between 1998 and 2015—Trends, characteristics, and cardiovascular disease risk. *Scandinavian Journal of Medicine & Science in Sports*, 30, 370–379. https://dx.doi.org/10.1111/sms.13581

Galatoulas, N-F., Genikomsakis, K.N. and Ioakimidis, C.S. (2020). Spatio-Temporal Trends of E-Bike Sharing System Deployment: A Review in Europe, North America and Asia. *Sustainability*, 12(11). https://doi.org/10.3390/su12114611

Heinen, E. and Bohte, W. (2014). Multimodal Commuting to Work by Public Transport and Bicycle - Attitudes Toward Mode Choice. *Transportation Research Record: Journal of the Transportation Research Board*, 2468, Transportation Research Board of the National Academies, Washington, D.C., 111–122. https://doi.org/10.3141/2468-13

Henriques-Neto, D. et al. (2020). Active Commuting and Physical Fitness: A Systematic Review. *International Journal of Environmental Research and Public Health*, 17(8). http://dx.doi.org/10.3390/ijerph17082721

Hickman, R. and Vecia, G. (2016). Discourses, travel behaviour and the 'last mile' in London. *Built Environment*, 42, 539-553. https://doi.org/10.2148/benv.42.4.539

ITF. (2020). *Safe Micromobility*. Corporate Partnership Board Report, International Transport Forum, OECD, February. https://www.itf-oecd.org/sites/default/files/docs/safe-micromobility_1.pdf

Ji, Y., Fan, Y., Ermagun, A., Cao, X., Wang, W. and Das, K. (2017). Public bicycle as a feeder mode to rail transit in China: The role of gender, age, income, trip purpose, and bicycle theft experience. *International Journal of Sustainable Transportation*, 11(4), 308-317. https://doi.org/10.1080/15568318.2016.1253802

Jonkeren, O. and Kager, R. (2020). Bicycle parking at train stations in the Netherlands: Travellers' behaviour and policy options. *Research in Transportation Business & Management*. https://doi.org/10.1016/j.rtbm.2020.100581

Kager, R., Bertolini, L. and Te Brömmelstroet, M. (2016). Characterisation of and reflections on the synergy of bicycles and public transport. *Transportation Research A: Policy and Practice*, 85, 208-219. http://dx.doi.org/10.1016/j.tra.2016.01.015

Krizek, K.J. (2011). *Bicycling Access and Egress to Transit: Informing the Possibilities*. Mineta Transportation Institute Publications. https://transweb.sjsu.edu/sites/default/files/2825_bicycling_access.pdf

La Paix, L., Cherchi, E. and Geurs, K. (2020). Role of perception of bicycle infrastructure on the choice of the bicycle as a train feeder mode. *International Journal of Sustainable Transportation*. https://doi.org/10.1080/15568318.2020.1765223

Laranjo, L. et al. (2020). Do smartphone applications and activity trackers increase physical activity in adults? Systematic review, meta-analysis and metaregression. *British Journal of Sports Medicine*. http://dx.doi.org/10.1136/bjsports-2020-102892

Lee, I-M., Shiroma, E.J., Kamada, M., Bassett, D.R., Matthews, C.E. and Buring, J.E. (2019). Association of Step Volume and Intensity With All-Cause Mortality in Older Women. JAMA *Internal Medicine*, 179(8), 1105-1112. https://doi.org/10.1001/jamainternmed.2019.0899

Lyons, G. (2020). Walking as a Service – does it have legs? *Transportation Research A: Policy and Practice*, 137, 271-284. https://doi.org/10.1016/j.tra.2020.05.015

Martens, K. (2007). Promoting bike-and-ride: The Dutch experience. *Transportation Research A: Policy and Practice*, 41, 326–338. https://doi.org/10.1016/j.tra.2006.09.010

Oeschger, G., Carroll, P. and Caulfield, B. (2020). Micromobility and public transport integration: The current state of knowledge. *Transportation Research D: Transport and Environment*, 89. https://doi.org/10.1016/j.trd.2020.102628

Panter, J. Desousa, C. and Ogilvie, D. (2013). Incorporating walking or cycling into car journeys to and from work: The role of individual, workplace and environmental characteristics. *Preventative Medicine*, 56, 211-217. http://dx.doi.org/10.1016/j.ypmed.2013.01.014

POLIS (2019). *Macro managing Micro mobility - Taking the long view on short trips*. POLIS discussion paper, November. https://www.polisnetwork.eu/wp-content/uploads/2019/11/Polis-Paper-Macromanaging-MicroMobility.pdf

Public Health England (2016). *Working Together to Promote Active Travel - A briefing for local authorities*. May. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/523460/Working_Together_to_Promote_Active_Travel_A_briefing_for_local_authorities.pdf

Pucher, J. and Buehler, R. (2009). Integrating Bicycling and Public Transport in North America. *Journal of Public Transportation*, 12 (3), 79-104. http://doi.org/10.5038/2375-0901.12.3.5

Ragaini, B.S. et al. (2020). A mixed-methods study of the demographic and behavioural correlates of walking to a more distant bus stop. *Transportation Research Interdisciplinary Perspectives*, 6. http://dx.doi.org/10.1016/j.trip.2020.100164

Rissel, C., Curac, N., Greenaway, M. and Bauman, A. (2012). Physical Activity Associated with Public Transport Use—A Review and Modelling of Potential Benefits. *International Journal of Environmental Research and Public Health*, 9, 2454-2478. https://doi.org/10.3390/ijerph9072454

Shergold, I. and Lyons, G. (2013). *Rethinking long distance travel - planning journeys that combine road and rail*. Paper based upon the Innovate-funded project ChoiceRail, unpublished, University of the West of England.

van Soest, D., Tight, M.R. and Rogers, C.D.F. (2020). Exploring the distances people walk to access public transport, *Transport Reviews*, 40(2), 160-182. https://doi.org/10.1080/01441647.2019.1575491

Venter, C.J. (2020). Measuring the quality of the first/last mile connection to public transport. *Research in Transportation Economics*, 83. https://doi.org/10.1016/j.retrec.2020.100949

Winstanley, K. (2020). *To what extent is running considered to be a commuting mode, and what factors influence it?* MSc dissertation, Newcastle University, August. https://www.reesjeffreys.co.uk/wp-content/uploads/2020/10/WinstanleyK.pdf

Appendix

Workshop participants and interviewees:

Kit Allwinter	Active Travel Policy Lead, West Yorkshire Combined Authority
James Austin	Sustrans London Director
Sarah Berry	Low Traffic Neighbourhood innovator and advocate
Mat Bonomi	Head of Transport and Access, Royal Parks
Scott Cain	Founder of Active Things and RunFriendly, Associate at Connected Places Catapult
Susan Claris	UKIMEA Active Travel Leader, Arup and Vice President Living Streets
Nick Evans	Head of Planning, Sport England
Karla Jakeman	Connected Transport Innovation Lead at Innovate UK, Vice Chair ITS (UK)
Simon Le Good	Active Travel Advisor, Transport for Wales
Glenn Lyons	Mott MacDonald Professor of Future Mobility, UWE Bristol
Matt Roebuck	Healthy Place Shaping Partner, Active Oxfordshire
Katy Taylor	Chief Strategy & Customer Officer, Go-Ahead Group
Georgia Yexley	TIER Mobility, Head of Cities, UK & Ireland

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