Exploring the relationship between the commuting experience and hedonic and eudaimonic well-being

Abstract

Studies linking commuting and well-being have received increasing attention in the field of mobility and transport. However, most studies primarily focus on the relationship between commuting and hedonic well-being. Few studies have investigated the commuting experience and eudaimonic well-being. Therefore, the aim of this paper is to explore the relationship between the commuting experience and both hedonic and eudaimonic well-being, using Heze (China) as a case study. The results indicate that, first, educational attainment is related to hedonic well-being, and transport mode is related to both the commuting experience and hedonic well-being. Furthermore, we found that some combinations of individual characteristics and transport mode are related to the commuting experience and hedonic well-being, but none of them relates to eudaimonic well-being. In addition, there are strong positive correlations between the commuting experience and hedonic well-being, between the commuting experience and eudaimonic well-being, and between hedonic and eudaimonic well-being. We also found that commuting by public transport, walking and cycling is more likely to improve the quality of the commuting experience, and both hedonic and eudaimonic well-being. In terms of policy implications, policymakers and transport planners should, therefore, promote people's well-being by prioritising the development of sustainable transport, and encouraging greater use of public transport and active travel.

Acknowledgements

Highlights

- We examine the relationship between the commuting experience and eudaimonic well-being.
- Educational attainment is related to hedonic well-being
- Individual characteristics are related to the commuting experience and hedonic well-being.
- Travelling by public transport, walking and cycling can improve eudaimonic well-being.
- Ways of measuring the commuting experience, hedonic and eudaimonic well-being are discussed.

1. Introduction

One of the ultimate goals of sustainable transport policies and projects should be the promotion of a higher level of well-being rather than just focusing on increased mobility. Various scholars have theorised about the nature of well-being. Ryan and Deci (2001: 142) examined academic theories about well-being, suggesting that the concept of well-being can be summarised as: 'optimal psychological functioning and experience'. Psychological functioning refers to the ability to realise individual goals within one's own environment and the external environment (Preedy and Watson, 2010). The concept of experience includes the experience of pleasure and the experience of having a sense of purpose and meaning in life (McMahan and Estes, 2011b; Ryff, 1989). McMahan and Estes (2011b) proposed that well-being plays a role in individuals' cognitive representations of the nature and experience of well-being. These concepts usually centre on two different but related philosophies: (1) hedonism and (2) eudaimonism (Kagan, 1992; McMahan and Estes, 2011a, 2011b; Ryan and Deci, 2001; Waterman, 1993; Waterman, Schwartz and Conti, 2008). McMahan and Estes (2011a: 95) argue that 'Hedonic and eudaimonic approaches to well-being can be further distinguished by the degree to which they rely on subjective versus objective criteria for determining wellness'. Some scholars have also suggested ways of measuring hedonic well-being and eudaimonic well-being, such as the Beliefs about Well-Being Scale (BWBS) (McMahan and Estes, 2011b), the Satisfaction with Travel Scale (STS) (Ettema et al., 2011) and the Flourishing Scale (FS) (Diener et al., 2010). In addition, an increasing number of studies have examined the relationships between individual characteristics (e.g., age, gender, educational attainment and

22 occupation) and well-being (Oguz et al., 2013; Stradling et al., 2007; Zijlstra and Verhetsel,

23 2021), and between travel characteristics (e.g., travel time and mode choice) and well-being

24 (Choi, Coughlin and D'Ambrosio, 2013; De Vos et al., 2016; Ye and Titheridge, 2017; and Zhu

25 et al., 2019).

26   Although previous studies have explored the relationship between the commuting

27 experience and well-being, some research gaps remain. First, few studies have discussed

28 affective factors and relevant measures of the commuting experience when investigating the

29 relationship between commuting experience and well-being. Second, most studies have tended

30 to focus on the relationship between travel and hedonic well-being (De Vos, et al., 2013; Ye and

31 Titheridge, 2020; and Zhu et al., 2019), while only a few empirical studies have considered the

32 relationship between eudaimonic well-being and travel (Mokhtarian, 2019; Vaitsis, Basbas and

33 Nikiforiadis, 2019). Third, because previous studies of Chinese cities have primarily focused

34 on mega cities rather than medium-sized or small cities (Ye and Titheridge, 2019; Zhu et al.,

35 2019), the policy implications derived from them may not be transferrable to a broader range

36 of cities. Thus, this paper aims to fill the research gaps by exploring the relationship between

37 the commuting experience and hedonic and eudaimonic well-being, using Heze, a medium-

38 sized Chinese city, as a case study. It makes three main contributions to the existing literature.

39 First, this empirical study investigates the relationship between travel behaviour and both

40 hedonic and eudaimonic well-being. Second, it contributes to furthering our knowledge of the

41 indirect relationship between commuting and eudaimonic well-being. Third, it enriches our

42 knowledge of the relationship between travel and the quality of the commuting experience, both

43   in terms of hedonic and eudaimonic well-being, in developing countries.

44   This study is organised as follows. Section 2 is a review of the existing literature regarding

45   the journey experience, hedonic well-being and eudaimonic well-being. Section 3 comprises an

46   introduction to the case study and the methodology. Section 4 presents the results of the

47   empirical study. Section 5 discusses the findings. The final section summarises the study and

48   provides policy implications.

49

2. Literature review

51   2.1 Journey experience

52   Enhancing the journey experience is essential for the future of public transport, especially

53   from a user perspective. Yet, journey quality, and affective factors in particular, are poorly

54   understood (Hickman et al., 2013). Through a study of leisure travel, Anable and Gatersleben

55   (2005) considered that affective factors are as important as instrumental factors with regard to

56   the journey experience. Carreira et al. (2014: 39) defined the journey experience as 'the total

57   individual responses originating from all passenger interactions with the transportation service

58   and across all moments of transportation provision'. Recent studies have mainly focused on the

59   journey experience in relation to public transport (Hine and Scott, 2000; Stradling et al., 2007).

60   Through qualitative research, Hine and Scott (2000) found transport interchange to be one of

61   the key factors affecting the journey experience, generally impacting negatively on public

62   transport users. Stradling et al. (2007) analysed experiences of bus journeys and summarised

63 eight underlying factors that affected them: safety concerns, preference for walking/cycling,

64 service availability, unwanted intrusions, preference for car travel, cost, difficulties resulting

65 from disability and discomfort, and self-perception. Their results showed that gender had a

66 statistically significant effect on safety and service availability, and age had an impact on seven

67 of the eight factors (except for self-perception) (Stradling et al., 2007). However, this research

68 did not take other individual characteristics into account, such as educational attainment and

69 occupation. The utility of travel is dependent on instrumental, attitudinal and affective factors

70 (Hickman et al., 2015; Steg, 2005). Hickman et al. (2013) conducted a door-to-door journey

71 survey and subsequently developed the Journey Experience Scale (JES), a 36-item Likert Scale

72 that can be used to measure journey experience. The JES includes instrumental dimensions (e.g.,

73 flexibility and cost), attitudinal dimensions (feelings about the quality of facilities), and

74 affective dimensions (e.g., whether people felt interested or bored, relaxed or anxious). Carreira

75 et al. (2014: 35) described another scale that can be used to measure journey experience

76 composed of 28 items and divided into seven dimensions: 'individual space, information

77 provision, staff skills, social environment, vehicle maintenance, off-board facilities, and ticket

78 line service'. Furthermore, in order to make soft interventions (Sloman, 2006) or wiser choices

79 (Cairns et al., 2004) to enhance the journey quality, it is essential to first gain a clear

80 understanding of the journey experience.

81   In this study, the journey experience primarily refers to the commuting experience.

82 According to the Collins English Dictionary, commuting can be defined as the activity of

83 regularly travelling to work, and this generally excludes travelling for social purposes, such as

84 shopping and visiting friends, etc. Chatterjee et al. (2020) reviewed and summarised previous

85 studies and concluded that commuting has the lowest positive affect scores and the highest

86 negative affect scores compared with other daily activities. The commuting experience consists

87 of instrumental factors and affective factors. Anable and Gatersleben (2005: 164) defined

88 instrumental factors as 'short-term individual instrumental costs and benefits of a particular

89 journey such as convenience, predictability, flexibility and monetary costs' and 'longer term

90 collective factors such as health and fitness and the environment'. Because affective factors

91 have previously been poorly understood (Hickman et al., 2013), this study focuses specifically

92 on the affective experience of commuting. Anable and Gatersleben (2005: 164) defined

93 affective factors as 'feelings evoked by travelling, such as stress, excitement, pleasure, boredom

94 and control'. Existing studies on affective factors in relation to the commuting experience have

95 primarily focused on stress (Chatterjee et al., 2020). Chatterjee et al. (2020) indicated that

96 crowding, congestion and unpredictability can induce commuting stress. However, improving

97 the service quality can reduce commuting stress by decreasing the time spent on commuting

98 and increasing predictability (Wener, Evans and Boately, 2005). By comparing the levels of

99 stress experienced by commuters using different travel modes, some more recent studies have

100 demonstrated that commuting by walking or cycling is the least stressful method, while

101 commuting by car is associated with the highest level of stress (Gatersleben and Uzzell, 2007;

102 Legrain, Eluru and El-Geneidy, 2015). In addition, the weather has a greater effect on those

103 who use active modes of commuting (Böcker, Dijst and Faber, 2016), while Legrain, Eluru and

104 El-Geneidy (2015) argued that feeling safer and more comfortable within their surroundings

105 can reduce the amount of commuting stress experienced by pedestrians. Based on a study of

106 commuters in San Francisco, Ory et al. (2004) found that commuters prefer modes of

107 commuting that involve less stress. Individual characteristics can also affect the levels of stress

108 experienced by commuters. For example, Wener, Evans and Boately (2005) showed that women

109 are more sensitive to commuting stress. Via a study of employees at the University of Surrey,

110 Gatersleben and Uzzell (2007) investigated other dimensions of the commuting experience.

111 Participants were asked to assess, for example, whether they found it pleasant, depressing,

112 exciting or boring. The responses showed that cyclists were more likely to feel pleasure and

113 excitement, pedestrians were more likely to find their commute pleasant and non-arousing, car

114 users reported sometimes feeling depressed but also experienced higher levels of excitement,

115 while public transport users found commuting depressing and boring (Gatersleben and Uzzell,

116 2007). Increases in the amount of time spent commuting lead to a lower level of satisfaction

117 with the commuting experience (Morris and Guerra, 2015). If the increase is caused by delays,

118 the commuting experience is unpleasant for both drivers and public transport users, while

119 pedestrians and cyclists regard safety and route quality as key factors affecting their enjoyment

120 of the commute (Chatterjee et al., 2020).

121 2.2 Hedonic well-being

122 The hedonic approach has dominated transport-related well-being studies. Kagan (1992),

123 Kahneman, Diener and Schwarz (1999) and Ryan and Deci (2001) proposed that hedonic well-

124 being is determined subjectively and is composed of pleasure and happiness. Similarly,

125 McMahan and Estes (2011b: 268) defined hedonic well-being as 'includ[ing] the experience of

126 pleasure, a lack of unpleasant experiences, and life satisfaction'. Waterman et al. (2010) also

emphasised that hedonic well-being is concerned with the subjective experiences of pleasure rather than the source of pleasure. Subjective well-being (SWB) refers to the way people experience their quality of life, focusing on satisfaction with life and the extent to which they experience pleasant feelings (Diener, 1984; Ettema et al., 2011). More specifically, SWB consists of two affective components (the presence of positive emotions and the absence of negative emotions) and one cognitive component (judgements: life satisfaction), which can be summarised as happiness, and which is used as a reference for measuring transport-related SWB (Cao and Ettema, 2014; Diener, 1984; Kahneman and Krueger, 2006; Kahneman, Wakker and Sarin, 1997; Ryan and Deci, 2001; Singleton and Clifton, 2021). Because there are no distinctions between the sources of well-being in the SWB paradigm, measures of SWB assess the overall level of satisfaction, which includes, but does not distinguish between, hedonic and eudaimonic well-being (Waterman et al., 2010). Disabato (2016) stated that the tripartite model of SWB (two affective components and one cognitive component) has been widely adopted to conceptualise hedonic well-being. Ryan and Deci (2001) emphasised that the hedonic approach focuses on SWB, and almost exclusively cited work on SWB when reviewing relevant theories and empirical research on hedonic well-being from the psychology literature. Most research into hedonic well-being uses the assessment of SWB as a measure of the former (Diener and Lucas 1999). Therefore, SWB with regard to the journey experience can be used to represent transport-related hedonic well-being in this study.

In recent years, increasing attention has focused on satisfaction with travel (Cao and Ettema, 2014; De Vos, 2019; Ettema et al., 2011; Ye and Titheridge, 2017; Ye, De Vos and Ma,

2020). In this paper, the journey primarily refers to commuting (Wu, Wang and Zhang, 2019; Zhu et al., 2019; Zijlstra and Verhetsel, 2021) – only focusing on the activity of regular travel to and from work and excluding social transit. The impacts of commuting time and commuting mode on commuting satisfaction/subjective well-being has also received attention within the existing literature. By exploring the impact of commuting time on SWB, some studies have identified a negative association between commuting time and commuting satisfaction; thus, people usually have lower levels of satisfaction or SWB if trips are longer in duration (Choi, Coughlin and D'Ambrosio, 2013; Zhu et al., 2019; and Zijlstra and Verhetsel, 2021). This outcome seems logical and is supported by other studies showing that, in general, longer commutes are stressful and are, thus, more likely to have negative impacts on commuters (Gatersleben and Uzzell, 2007; Koslowsky, Kluger and Reich, 1995). Based on data from the 2014 China Labour-force Dynamics Survey, Yin et al. (2019) also found that commuters with longer commuting times have lower levels of satisfaction regardless of which commuting modes they choose. In addition to commuting time, commuting mode choice also significantly affects SWB. Many studies have confirmed that active travel has a more positive effect on SWB than motorised travel (Abou-Zeid and Ben-Akiva, 2011; Smith, 2013; St-Louis et al., 2014; Ye and Titheridge, 2017). Abou-Zeid and Ben-Akiva (2011) and Smith (2013) suggested that those who commute by bicycle and/or on foot have significantly higher levels of commuting satisfaction than their counterparts who commute by public transport or car. Based on a single-mode survey conducted among commuters in Canada, St-Louis et al. (2014) found a similar outcome; i.e., cyclists and pedestrians are more likely to feel satisfied with their commutes than car drivers and bus users. Ma and Ye (2019) found that people who cycle are more likely to

170 experience positive impacts on their mental health than those who walk. However, there is little

171 consensus on the relationship between commuting patterns and SWB in the literature. For

172 instance, Zhu et al. (2019) explored 13,261 individual, 124 city, and 401 neighbourhood

173 samples from the 2014 China Labour-Force Dynamics Survey and found the opposite;

174 commuters who walk or cycle are more likely to have lower levels of subjective well-being

175 than commuters who use other modes of travel. This was due to sub-standard sidewalks and

176 bicycle lanes, a lack of safety measures and traffic pollution; hence, the experience was not

177 pleasurable. Ye and Titheridge (2017) observed that people who commute by electric bikes have

178 relatively lower levels of satisfaction. In addition, traffic congestion is an underlying factor that

179 increases commuting stress, leading to lower levels of commuting satisfaction (Ye and

180 Titheridge (2017). Based on a sample survey of 6,422 respondents in Beijing, Wu, Wang and

181 Zhang (2019) found that people using shuttle buses tend to have higher levels of satisfaction

182 than those using other modes of transport, particularly in congested traffic conditions. Zhu et

183 al. (2019) also investigated the impacts of individual characteristics (e.g., education and gender)

184 on SWB. They found that people with higher levels of educational attainment tend to have

185 higher levels of SWB, and females living in urban areas are more likely to have higher levels

186 of SWB than males. Although conventional wisdom and research suggest that commuting is a

187 stressful activity (Koslowsky, Kluger and Reich, 1995), most studies on the impact of travel

188 found that about half of the subjects were relatively happy with their commute and had found

189 their recent experiences of commuting pleasant (Singleton and Clifton, 2021).

2.3 Eudaimonic well-being

Happiness is not an end in itself, and the focus of well-being should be on realising one's true potential value (McMahan and Estes, 2011a; Ryff, 1989). Fromm (1947) asserted that well-being can be achieved by satisfying objectives and valid needs rooted in human nature. A eudaimonic view conceptualises well-being in terms of cultivating personal strengths and conferring greater benefits; i.e., the eudaimonic dimension of 'flourishing' (Aristotle, trans. 2000), which involves following one's inner essence and profoundly held values, feeling more than just happiness and pleasure, emphasising the achievement of self-worth and goals (Waterman, 1993), realising one's true potential values (Ryff and Keyes, 1995), and the experience of a purposeful and meaningful life (Ryff, 1989). Existing concepts of eudaimonic well-being diverge widely, but there are two key points on which they agree; they contain some components of self-development/personal growth and meaning in life, and they do not contain any affective components (Ryan and Deci, 2001). While the hedonic approach focuses on subjective well-being, the eudaimonic approach focuses on psychological well-being (PWB) (Ryan and Deci 2001; Schwanen, 2021). PWB is the most common factor in the theory of eudaimonia and can be equated to positive functioning (Ryff and Singer, 1998). Ryan and Deci (2001: 141) defined eudaimonic well-being in terms of 'the degree to which a person is fully functioning.' McMahan and Estes (2011b: 269) summarised previous research and defined eudaimonic well-being as 'includ[ing] the experience of meaning or purpose, the development of personal strengths, and contribution to society'. Waterman et al. (2010: 41) pointed out that eudaimonic well-being 'has emerged as both a complement and contrast to subjective well-

being (SWB) for understanding and studying quality of life.' In short, eudaimonic well-being, which focuses on PWB (Ryan and Deci, 2001; Schwanen, 2021), emphasises objectively beneficial experiences (Kagan, 1992).

Some research has explored the specific content of eudaimonic well-being. When describing the eudaimonic approach to well-being, Ryan and Deci (2001) and Waterman et al. (2010) drew on previous work by Ryff and colleagues on PWB (Ryff, 1989; Ryff and Keyes, 1995; Ryff and Singer, 2008). Ryff (1989: 1072) identified six dimensions, which they considered essential to the quality of life, which were subsequently adopted by Ryan and Deci (2001), namely: 'self-acceptance, positive relations with others, autonomy, environmental mastery, purpose in life, and personal growth'. These can be used to reflect the quality of life in terms of eudaimonic well-being, 'derived from the development of a person's best potentials and their application in the fulfilment of personally expressive, self-concordant goals' (Waterman et al., 2010: 41). However, not every study agrees with the division of eudaimonic well-being into these six dimensions. In their recent academic work, Diener et al. (2010) optimised previous research and reported that eudaimonic well-being can be divided into five main measurable dimensions: social relationships, optimism and self-respect, a purposeful and meaningful life, engagement and interest, being competent and capable at activities. Having meaning in one's life is essential to eudaimonic well-being (Ryan and Deci, 2001), and this can be increased by undertaking eudaimonic activities related to self-development and contribution to society (Waterman, 2005). Positive subjective experiences and a higher level of well-being result from these eudaimonic activities according to the concept of eudaimonic well-being

232 (Diener and Lucas, 1999). Furthermore, McMahan and Renken (2011) found that the concept

233 of eudaimonic well-being is positively associated with self-reported well-being and having a

234 meaningful life.

235   Travel affects both hedonic and eudaimonic well-being (De Vos et al., 2013). Based on

236 previous studies, hedonic well-being has been generally understood well, whereas eudaimonic

237 well-being has been largely ignored. De Vos et al. (2013: 426) emphasised that 'well-being is

238 more than satisfaction and affect, and activities that are enabled by travel and/or that people

239 undertake during trips allow them to achieve a sense of purpose and meaning in life'. Using a

240 questionnaire survey conducted in Thessaloniki, Vaitsis, Basbas and Nikiforiadis (2019)

241 explored the relationship between six factors (safety, comfort, physical health, self-confidence,

242 autonomy and mental health) and travel mode choice, and concluded that factors relating to

243 eudaimonic well-being have a significant impact on travel mode choice. The results showed

244 that walking scored higher than other travel modes, cycling scored highly regarding physical,

245 self-confidence, autonomy and mental health, but lower in terms of safety and comfort; public

246 transport was rated significantly lower because of the poor quality of public transport services

247 in the city. Some individual characteristics are closely related to eudaimonic well-being; for

248 example, Ryff and Singer (2008) identified a close relationship between educational attainment

249 and eudaimonic well-being. More specifically, educational attainment is positively related to

250 personal growth and purpose. These findings are supported by Dowd's (1990) observation that

251 the opportunities for realising oneself are unevenly distributed and dependent on resource

252 allocation, which enables only some to make the most of their talents and capacities. Ferguson

253 and Gunnell (2016) stated that differences between women and men in terms of eudaimonic

254 well-being are equivocal and claimed that research has demonstrated significant differences

255 between genders. However, other studies have found minimal gender differences. Thus,

256 evidence relating to gender differences in terms of eudaimonic well-being is conflicting across

257 the literature. Based on the Hedonic and Eudaimonic Motives for Activities (HEMA) scale,

258 Huta (2016) identified little connection between eudaimonic well-being and gender and age

259 (Huta and Ryan, 2010). Although some studies have focused on occupation function, no clear

260 relationship between occupation and eudaimonic well-being has been identified. Therefore, this

261 research examines the associations between individual characteristics (e.g., age, gender,

262 educational attainment and occupation) and eudaimonic well-being.

263 2.4 Measurement of hedonic well-being and eudaimonic well-being

264 Most academics generally agree that hedonic well-being/SWB consists of two affective

265 components (the presence of positive feelings and the absence of negative feelings) and one

266 cognitive component (life satisfaction) (Diener, 2009; Diener, 1984; Singleton and Clifton,

267 2021). The two affective components are related to how people feel over a short time-period,

268 and the cognitive component is related to how people feel in the long-term (De Vos et al., 2013).

269 The Swedish Core Affect Scale (SCAS), the Positive and Negative Affect Schedule (PANAS),

270 and the Scale of Positive and Negative Experience (SPANE) can be used to measure the

271 affective components of SWB (Diener et al., 2010; Västfjäll et al., 2002; Watson, Clark and

272 Tellegen, 1988). The PANAS and the SCAS were developed to measure feelings in the short-

273 term, while the SPANE is an alternative to the PANAS and SCAS (De Vos et al., 2013; Diener

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274   et al., 2010). The Personal Well-Being Index (PWI) and the Satisfaction with Life Scale (SWLS)

275   can be used to measure the cognitive components of SWB (Cummins et al., 2003; Diener et al.,

276   1985). Given that SWB contains both affective components and cognitive components, Ettema

277   et al. (2011) developed the Satisfaction with Travel Scale (STS), based on the SCAS (Västfjäll

278   et al., 2002) and Russell's model of core affect (1980). The STS, designed to measure travel-

279   specific SWB, consists of two affective factors and one cognitive factor, and has been widely

280   used to explore commuting satisfaction regarding travel modes and travel time. Each factor

281   comprises three items. There are six affective items – 'three which distinguish between positive

282   deactivation (e.g., relaxed) and negative activation (e.g., time pressed) and three which

283   distinguish between positive activation (e.g., alert) and negative deactivation (e.g., tired)'

284   (Ettema et al., 2011: 170). The three items that comprise the cognitive factor relate to the overall

285   quality and efficiency of transport services. Singleton and Clifton (2021: 307) described the

286   STS as 'using nine pairs of adjectives or statements assessed on a seven-point semantic

287   differential scale'. Previous studies have confirmed that this measurement structure, comprising

288   three components (two affective and one cognitive) is consistent with the theory (Friman et al.,

289   2013; Glasgow et al., 2018; Olsson et al., 2012). Singleton and Clifton (2021) also maintained

290   that the STS is an effective instrument to assess hedonic SWB concerning travel. Because the

291   STS is comprised of relatively limited components and items, it is impossible to use it to

292   conduct more in-depth investigations of the sources of travel-related SWB; thus, the STS is not

293   suitable for measuring eudaimonic well-being in the travel domain.

294   Given the volume and diversity of the existing eudaimonic literature, Haybron (2016: 43)

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295   focused on self-report scales and summarised five representative approaches to eudaimonic

296   well-being as follows: 'Self-Determination Theory (Ryan and Deci, 2001; Ryan, Huta and Deci,

297   2008); Psychological Well-Being (Keyes, 2007; Ryff, 1989; Ryff and Singer, 2008); Personal

298   Expressiveness (Waterman, 1993; Waterman, Schwartz and Conti, 2008); PERMA [positive

299   emotions (P), engagement (E), relationships (R), meaning (M), accomplishment (A)] (Seligman,

300   2011); and The Flourishing Scale (Diener et al., 2009)'. Brandel, Vescovelli and Ruini (2017)

301   summarised a total of twelve instruments that can be used to measure eudaimonic well-being

302   and applied four of them to measuring the eudaimonic well-being of clinical populations,

303   namely: the Mental Health Continuum (Keyes, 2002; Keyes, 2005; Keyes, 2006), the

304   Flourishing Scale (Diener et al., 2010), the General Causality Orientations Scale (Deci and

305   Ryan, 1985), and the Orientations to Happiness Subscales (Peterson, Park and Seligman, 2005).

306   Similarly, Singleton and Clifton (2021) summarised three commonly-used scales: the Personal

307   Well-Being Scale (PWS) (Ryff, 1989), the Questionnaire for Eudaimonic Well-Being (QEWB)

308   (Waterman et al. 2010), and the Flourishing Scale (FS) (Diener et al., 2010). It is clear from this

309   that the Flourishing Scale (FS) has received widespread attention and been applied in various

310   studies. The FS, developed by Diener and colleagues, describes 'important aspects of human

311   functioning ranging from positive relationships, to feelings of competence, to having meaning

312   and purpose in life' (Diener et al., 2010: 146) and can be used to effectively assesses overall

313   self-reported psychological well-being. The FS consists of eight-items that relate to five

314   dimensions: purpose and meaning in life, contribution to others, supportive relationships, being

315   respected, interest and engagement in activities, self-respect, optimism, and competence

316   (Diener et al., 2010). However, fewer studies have explored travel-related eudaimonic well-

being. Singleton and Clifton (2021) explained that it is not always easy to apply existing

measurements to the travel domain, while questionnaires cannot necessarily capture implicit

travel-related eudaimonic motivations and responses. Travel-related eudaimonic motivations

are directly associated with three needs: relatedness, autonomy and competence, which are

derived from Self-Determination Theory (SDT); 'this is another perspective that has both

embraced the concept of eudaimonia, or self-realization, as a central definitional aspect of well-

being and attempted to specify both what it means to actualize the self and how that can be

accomplished' (Ryan and Deci, 2001: 146; Ryan, Huta and Deci, 2008). Diener et al. (2010)

verified that items in the FS correlate to these three needs; thus, the FS can be used to capture

and reflect eudaimonic travel motivations. On the one hand, the FS can measure most

dimensions of eudaimonic well-being; on the other hand, the FS contains considerably fewer

items than other measurement scales (e.g., PWS), which makes it more concise, accessible and

feasible to use when conducting a survey. Proctor and Tweed (2016) also suggested that the FS

could be considered as a suitable means of measuring eudaimonic well-being.

2.5 Connections between journey experience, hedonic well-being and eudaimonic well-being

The concept of well-being usually centres on two divergent but related philosophies:

hedonism and eudaimonism. Hedonic well-being focuses on subjectively pleasant experiences,

whereas eudaimonic well-being concentrates more on experiences that are objectively

beneficial for the individual (Kagan 1992; McMahan and Estes, 2011a; Ryan and Deci, 2001).

In the case of hedonic well-being, pleasure or happiness is viewed as an end in itself; in contrast,

from the perspective of eudaimonic well-being, the goal is to realise one's true potential value,

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338 and the value of the eudaimonic activity itself prompts the activity rather than the accompanying

339 subjective experiences (Ryan and Deci, 2001; Waterman, Schwartz and Conti, 2008; Waterman

340 et al., 2010). On the one hand, McMahan and Estes (2011b) found that, compared with hedonic

341 dimensions, eudaimonic dimensions are more strongly associated with the experience of well-

342 being. On the other hand, empirical research is unable to determine the precise relationship

343 between the hedonic approach and psychological health, but it has been established that

344 eudaimonic well-being is positively associated with healthy psychological functioning

345 (McMahan and Estes, 2011a; Steptoe, Deaton and Stone, 2015). Therefore, eudaimonic, rather

346 than hedonic, may be a more important overall concept of well-being. Steger, Kashdan and

347 Oishi (2008) also claimed that hedonic well-being, obtained from simple pleasant experiences,

348 is likely to disappear in the short term – although there is also the hedonic treadmill suggesting

349 that subject well-being is relatively stable. In contrast, eudaimonic well-being gained from

350 beneficial individual developmental experiences is likely to last for a long time. Waterman,

351 Schwartz and Conti (2008) proved a robust positive correlation between hedonic and

352 eudaimonic well-being measures using the Personally Expressive Activities Questionnaire-

353 Standard Form (PEAQ-S). Waterman and colleagues also suggested that an asymmetry exists

354 between hedonic and eudaimonic well-being; thus there is greater probability of an activity

355 receiving a higher score in terms of hedonic well-being when it scores highly in terms of

356 eudaimonic well-being; however, there is lower probability of an activity scoring highly with

357 regard to eudaimonic well-being when it is rated highly in relation to hedonic well-being

358 (Waterman, 1993; Waterman, Schwartz and Conti, 2008).

359   Two standard hedonic and eudaimonic well-being classifications are used in the existing

360   literature when measuring well-being in the travel domain. Singleton and Clifton (2021)

361   deemed that measures of SWB should include both hedonic (components of affective and

362   cognitive) and eudaimonic approaches. However, most studies have maintained that the

363   hedonic approach focuses on SWB, while the eudaimonic approach focuses on psychological

364   well-being (PWB) (Diener and Lucas 1999; Disabato, 2016; Ryan and Deci, 2001; Ryff, 1989;

365   Ryff and Keyes, 1995; Ryff and Singer, 1998). Thus, in this study, we adopt the STS (related to

366   SWB) to measure hedonic well-being and the FS (based on PWB) to measure eudaimonic well-

367   being. Previous studies have indicated that, compared with hedonic motivations, eudaimonic

368   motivations are more directly related to well-being (Henderson, Knight and Richardson, 2014;

369   Huta and Ryan, 2010). As previously mentioned, travel-related eudaimonic motivations are

370   generally directly associated with the three needs from Self-Determination Theory: relatedness,

371   autonomy and competence (Ryan and Deci 2000, 2001; Ryan, Huta and Deci, 2008). Although

372   eudaimonic travel motivations are implicit, items from the FS correlate with these three needs

373   from Self-Determination Theory (Diener et al., 2010); thus, the FS may capture and reflect

374   travel-related eudaimonic motivations.

375   There is increasing evidence to indicate that well-being is affected by different aspects of

376   transport, including individual, social, and environmental factors (De Vos et al., 2013;

377   Mokhtarian, 2015). Overall, existing studies have mainly focused on three elements: 1)

378   investigating the impacts of specific aspects of the commuting experience (e.g., commuting

379   time and mode choice) on commuting satisfaction (Choi, Coughlin and D' Ambrosio, 2013;

380 Wu, Wang and Zhang, 2019; Ye and Titheridge, 2017; Zhu et al., 2019; Zijlstra and Verhetsel,

381 2021); 2) exploring the distinction and association between hedonic and eudaimonic well-being

382 (McMahan and Estes, 2011a; 2011b; Kagan 1992; Ryan and Deci, 2001; Steger, Kashdan and

383 Oishi, 2008; Waterman, 1993; Waterman, Schwartz and Conti, 2008); and 3) examining the

384 associations between individual characteristics (e.g., age, gender, educational attainment and

385 occupation) and journey experience and well-being (Oguz et al., 2013; Stradling et al., 2007;

386 Zijlstra and Verhetsel, 2021). However, first, few studies have investigated affective factors and

387 the relevant measurement of the commuting experience; second, few studies have explored the

388 relationship between the commuting experience and eudaimonic well-being. Our paper,

389 therefore, aims to fill the research gaps by simultaneously exploring the commuting experience,

390 hedonic well-being and eudaimonic well-being.

391

392 3. Case study, data and methodology

393 3.1 Case study

394   Heze, a developing, medium-sized city in the southwest of Shandong Province, China,

395 located at the centre of four provinces: Shandong, Jiangsu, Henan, and Anhui, was chosen as

396 the case study area for this research (Figure 1). The administrative planning region of Heze

397 consists of 2 districts, 7 counties and 2 development zones, having, in 2019, a total land area of

398 12,238.62 km^2 and 8.78 million residents. In this study, the discussion and analysis mainly

399 focus on the downtown area and urban fringe area, including Mudan District, the Economic

400 and Technological Development Zone, Dingtao District and the High-Tech Industrial
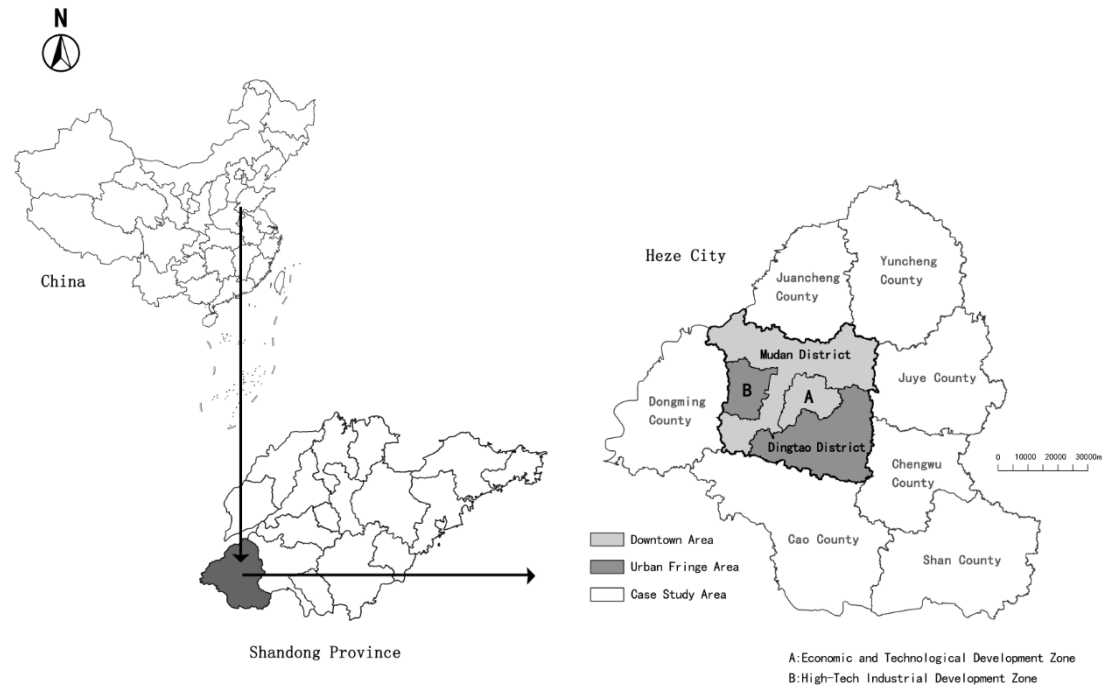
401 Development Zone.

402

404   Previous research on Chinese cities has primarily focused on mega cities, such as Beijing,

405 Shanghai, and Xi'an, rather than smaller cities. Consequently, the policy implications derived

406 from previous studies may not be transferrable to a broader range of cities because of their

407 differential characteristics. Therefore, by focusing on Heze, the study supplements existing

408 policy implications to address transport problems and promote well-being in relatively small

409 Chinese cities.

410 3.2 Data source and data sample

411   Data were collected in two stages, from May to July 2019, in Heze. In the first stage, we

20

412 interviewed 14 planning practitioners; in the second stage, we distributed 263 questionnaires to

413 local residents and eventually collected 188 valid samples. We used a random sampling

414 approach involving face-to-face surveys, similar to the approach previously used by Cao and

415 Hickman (2019, 2020). A mixed approach, encompassing both quantitative and qualitative

416 methods, was applied to obtain more critical research outcomes.

417 3.2.1 Practitioner interviews

418 The practitioner interviews covered three topics: 1) current transport issues; 2) transport

419 development opportunities; and 3) attitudes of government policymakers and planners towards

420 different transport modes. The practitioner interviews briefly introduced some basic contextual

421 information about the transport system in Heze, which can be used to support local and regional

422 policy making.

423 3.2.2 Paper questionnaire

424 The paper questionnaire contained four parts: 1) individual characteristics; 2) travel

425 behaviour; 3) journey experience; and 4) hedonic and eudaimonic well-being. Individual

426 characteristics comprised gender, age, occupation and education. In this study, travel behaviour

427 refers to daily commuting mode choice; for example, cars, buses, walking, bicycles, and electric

428 bicycles. It should be noted that buses are the only public transport option available in Heze as

429 there is currently no metro system. The Journey Experience Scale (JES), which contains twenty

430 items, as shown in Table 1, was developed from the Door-to-Door Journey Survey conducted

431 by Hickman et al. (2013). The JES was used to quantitatively assess the commuting experience.

432　The scale contains five degrees of evaluation and ranges from -2 (strongly disagree) to 2

433　(strongly agree). The Satisfaction with Travel Scale (STS) (Ettema et al., 2011), which contains

434　nine items (Table 2), is used to measure hedonic well-being and includes affective and cognitive

435　components. Each item is rated on a scale ranging from -3 (strongly negative) to 3 (strongly

436　positive). The Flourishing Scale (FS) (Diener et al., 2010) (Table 3), is used to measure

437　eudaimonic well-being and covers eight essential items relating to eudaimonic dimensions of

438　well-being. Each item is rated on a scale ranging from 1 (strongly disagree) to 7 (strongly agree).

439

440　**Table 1** Journey experience scale (JES) (Hickman et al., 2013)

	-2 Strongly disagree	-1 Disagree	0 Neutral	1 Agree	2 Strongly agree
I felt safe and secure on the journey link					
The journey was quick and convenient					
The journey was cheap					
Using this mode is good for my status					
Access to my usual travel mode is quick and easy					
I arrived punctually					
The carriage/cabin was comfortable with good seats and plenty of space					
There was no congestion on the route					
I hardly needed to wait for a transfer during the journey					
The carriage/cabin was not too noisy					
Wifi was available and easy to use					
There was some opportunity for social interaction					
The route was clean					
There was good protection against the weather					
I enjoyed being in the fresh air					
I benefited from doing some exercise					
I could pop into the shops or visit other things on the way					
I could read or listen to music					

| | I could enjoy the view and scenery |
| | I felt happy and relaxed |

441

442 **Table 2** Satisfaction with travel scale (STS) (Ettema et al., 2011: 170)

		-4	-3	-2	-1	0	1	2	3	4	
Positive deactivation to negative activation	Time pressed										Time relaxed
	Worried I would not be in time										Confident I would be in time
	Stressed										Calm
Positive activation to negative deactivation	Tired										Alert
	Bored										Enthusiastic
	Fed up										Engaged
Cognitive evaluation	Travel was worst I could remember										Travel was best I could remember
	Travel was low standard										Travel was high standard
	Travel did not work well						`				Travel worked well

443

444 **Table 3** Flourishing Scale (FS) (Diener et al., 2010: 148)

	1	2	3	4	5	6	7
	Strongly disagree	Disagree	Slightly disagree	Neutral	Slightly agree	Agree	Strongly agree
Purpose and meaning							
Supportive relationships							
Engaged							
Contribute to others							

Competence

Good person

Optimistic

Respected

445   Table 4 shows the descriptive analysis of our data. Comparing all the transport modes, the

446   number of respondents who used public transport (buses) and active travel accounted for only

447   around 30% of the total, of which active travel (e.g., walking and cycling) amounted to 15%.

448   Respondents who commuted by car accounted for the largest proportion at 40%. Levy (2013)

449   claimed that financial, cultural, physical, locational and gender-related factors may affect an

450   individual's choice of transport mode. Due to financial constraints, 42% of respondents in the

451   age-range 18-24 chose buses as their most utilised mode of commuting. Feng (2017) found that

452   older adults in Nanjing were heavily reliant on walking, public transport and cycling. This result

453   is also in line with our findings, which show that 78% of people aged over 65 in Heze use buses

454   or walking as their primary travel modes. In addition, 43% of government officials were likely

455   to use private cars, while 36% of teachers tended to use electric bikes, possibly because of the

456   trade-off between traffic congestion and traffic speed on their journey to work.

457

458   **Table 4** Descriptive statistics (n=188**)**

Categories		Frequency	Percentage (%)
Gender	Male	74	39.
	Female	114	61
Age	18-24	36	19
	25-44	94	50
	45-64	40	21
	65+	18	10
Educational Attainment	Below bachelor's degree	34	18

	College	38	20
	Undergraduate	99	53
	Postgraduate	17	9
	Government official	42	22
	Doctor	14	7
	Teacher	28	15
Occupation	Company or factory worker	42	22
	Freelance or businessman/woman	20	10
	Student	24	13
	Retiree	18	10
	Cars	76	40
	Buses	29	15
Transport Mode	Walking and cycling	28	15
	Electric bicycles	55	30

459

460   3.3 Quantitative methods

461   3.3.1 Analysis of variance (ANOVA) and multivariate analysis of variance (MANOVA)

462   The ANOVA test allows comparison of two or more groups simultaneously to determine

463   whether there is a relationship between them. The generalised ANOVA is used for testing a

464   categorical factor when one needs to calculate explained and residual sums of squares (SS),

465   degrees of freedom (d.f.), mean squares (MS) and the F-ratio, as shown in the following

466   equations (Doncaster and Davey, 2007: 10):

467
$$SS_{exp} = \sum_{i=1}^{a} n \cdot (\bar{y}_i - \bar{\bar{y}})^2 \tag{1}$$

468
$$SS_{res} = \sum_{i=1}^{a} \sum_{j=1}^{n} (y_{ij} - \bar{y}_i)^2 \tag{2}$$

469

470   **Table 5** Generalised ANOVA table (Doncaster and Davey, 2007: 10)

Coefficient	Formula

25

$d.f._{exp}$	$\alpha - 1$
$d.f._{res}$	$(n\text{-}1)\ \alpha$
MS_{exp}	$SS_{exp}/d.f._{exp}$
MS_{res}	$SS_{exp}/d.f._{res}$
F-ratio	MS_{exp}/MS_{res}

471

472   ANOVA uses the F statistic to compute the probability P. The probability P is the

473   significance value between the variables being analysed, and the factor is deemed to have a

474   significant effect if $P < 0.05$ (Doncaster and Davey, 2007).

475   MANOVA, which can be used to examine multiple dependent variables, is used to assess

476   the following three dimensions: 1) whether the independent variables have statistically

477   significant effects on dependent variables; 2) the interactions between dependent variables; and

478   3) the interactions between independent variables (Singh, 2018).

479   3.3.2 Regression

480   Regression is used to examine the strength and character of the relationship between one

481   response (dependent) variable and one or more predictor (independent) variable(s) (Rutherford,

482   2011). The Cartesian coordinate system can be used to generate a regression curve that

483   corresponds with the regression function (PSECS, 2019; Seltman, 2018). The basic equation

484   for the regression model takes the following form (Rutherford, 2011: 10):

$$Y_i = \beta_0 + \beta_1 X_i + \varepsilon_i \tag{3}$$

486   Where:

487   i : denotes values for the ith subject (where i = 1,2,..., n);

488   Y_i : is the predicted dependent variable score for the ith subject;

489   β_0 : is a constant (the intercept);

490   β_1 : is a coefficient (the slope of the regression line);

491   X_i : is the value of the independent variable recorded for the same i^{th} subject;

492   ε_i : is the random variable parameter denoting the error term for the same i^{th} subject.

493   The regression equation can be simply expressed as:

$$Y = \beta_0 + \beta_1 X \tag{4}$$

495   Where:

$$\beta_0 = \frac{n(\sum xy) - (\sum x)(\sum y)}{n(\sum x^2) - (\sum x)^2} \tag{5}$$

$$\beta_1 = \frac{(\sum y)(\sum x^2) - (\sum x)(\sum xy)}{n(\sum x^2) - (\sum x)^2} \tag{6}$$

498

499   When $\beta_1 > 0$, there is a positive correlation between X and Y ; When $\beta_1 < 0$, there

500   is a negative correlation between X and Y . The multiple R, as the correlation coefficient,

501   reveals the strength of the linear relationship; R squared, as the determination coefficient,

502   indicates the number of points on the regression line. The multiple R and the R squared values

503   continuously range from 0 to 1. A multiple R value closer to 1 means a stronger positive

504   relationship, while an R squared value closer to 1 means that more values fit the regression

505   model.

506

4. Results

4.1 Results of practitioner interviews

In response to the question, 'What are the current problems with transport in Heze?', the practitioners identified fourteen main problems from which each practitioner chose what they perceived as the five most important. Table 6 illustrates how often the transport issues listed were chosen by practitioners. The percentage value corresponds with the scale; thus, for 'Serious traffic jams' the scale is 12, as twelve practitioners identified this problem. As the fourteen practitioners taking part each selected five main problems, the percentage for the first item is 12/(14*5)=17.14%. A higher scale value indicates that the problem is considered more serious. The three most serious problems identified were traffic congestion, resulting in longer commuting times, low levels of satisfaction during journeys, and limited choice of public transport mode (bus is the only option, see Fang et al., 2021).

519

Table 6 Current transport problems in Heze

Current Problems	Scale	Percentage（%）
1. Serious traffic jams	12	17.14
2. Limited public transport system (only buses available)	10	14.29
3. Lower levels of satisfaction during journey	10	14.29
4. Lack of funds	7	10
5. Lack of interconnecting stations and modes of transfer	5	7.14

6. Service provision is lagging behind rapid city expansion	5	7.14
7. Lack of parking lots	4	5.71
8. Lack of effective traffic management	4	5.71
9. Low level of public transport services	3	4.29
10. Low level of urbanisation	3	4.29
11. Inadequate road network structure	3	4.29
12. No long-term planning by local government	2	2.86
13. Disparity between government theory and practice policy	1	1.43
14. Public expectations cannot be adequately met	1	1.43

521   Each practitioner selected 5 problems that they considered most serious.

522   In response to the question: 'What opportunities are there for transport development in

523   Heze?' the practitioners identified eight opportunities and selected the five they considered most

524   important (see Table 7). The percentage value corresponds to the scale. A higher scale value

525   means that the corresponding opportunity is considered more important. Due to Heze's superior

526   location, the practitioners stated that different levels of government provided varying levels of

527   support for transport development.[1] They believed that the local government preferentially

528   promoted development of sustainable transport, including walking, cycling and public transport.

529   Considering the current lack of public transport options (only buses currently available) and the

530   low quality of public transport services, the local government has decided to build a metro

531   system to give people more transport options.

[1] Heze has an outstanding locational advantage, being at the junction of Shandong, Henan, Jiangsu and Anhui provinces, and is also located within the coverage of the Central Plains urban agglomeration and the Shandong Peninsula urban agglomeration under the next national key plan. However, the current transport system has some failings, such as the lack of multiple public transport modes, lack of transfer stations, the incomplete road network and lack of relevant services, so the practitioners felt that the government should make this a greater priority.

532

Opportunities	Scale	Percentage （%）
1. Local government to promote and implement sustainable transport, such as walking, cycling and public transport	12	17.14
2. Strong funding support from central government	10	14.29
3. Provincial government proposes development policies and programs	10	14.29
4. Light rail, subway, and tram development plan	10	14.29
5. Improve quality of public transport	9	12.86
6. People-oriented policy and planning strategies	7	10
7. Increase construction of parking lots	6	8.57
8. Strengthen traffic demand management	6	8.57

Each practitioner selected 5 opportunities that they considered most important.

Table 8 shows the attitudes of policymakers and planners towards different transport

modes. A positive attitude means that most experts support the relevant transport modes, and a

negative attitude indicates that they oppose them. The results of practitioner interviews show

that policymakers and planners support travelling/commuting by walking, cycling and bus.

However, they oppose travelling by private cars and electric bicycles. Current transport policies

are designed to encourage use of active travel and public transport to reduce dependence on

private vehicles, as highlighted by policymakers and planners. In addition, they claim that

electric bicycles are difficult to control, and e-bikers often violate traffic rules in Heze.

Table 8 Policymakers and planners' attitudes towards different transport modes

Transport mode	Policymaker	Planner
Car	×	×

		√	√
Bus		√	√
Walking		√	√
Bicycle		√	√
Electric bicycle		×	×

Note: ' √ ': positive; '×': negative; '/': neutral

545

4.2 Survey results

547   The analyses in this section focus on five categorical variables (gender, age, occupation,

548 education and transport mode) and three scale variables (JES, STS and FS).

549 4.2.1 ANOVA

550   ANOVA is used to determine the significance between each categorical variable and each

551 scale variable. If the five categorical variables are treated as independent variables and the three

552 scale variables as dependent variables, a 5×3 matrix with significance values can be obtained

553 from the ANOVA (Table 9).

554

555 **Table 9** Significance values obtained from ANOVA

Variables	Journey Experience Scale	Satisfaction with Travel Scale	Flourishing Scale
Gender	0.579	0.598	0.691
Age	0.051	0.163	0.600
Occupation	0.258	0.717	0.989
Education	0.061	**0.015**	0.250
Transport Mode	**0.000**	**0.006**	0.081

556   The results show that three significance values are smaller than 0.05: those between

557　transport mode and JES (0.000); between education and STS (0.015), and between transport

558　mode and STS (0.006). Thus, the results indicate that transport modes relate to journey

559　experience; both transport mode and educational factors are related to hedonic well-being; and

560　there is no relationship between each of the categorical variables and eudaimonic well-being.

561　4.2.2 MANOVA

562　　　MANOVA offers insight into the relationship and interaction effect between each

563　combination of categorical variables and each scale variable. In this study, MANOVA can be

564　used to analyse up to three categorical variables and one scale variable simultaneously. It is

565　unnecessary, therefore, to explore the interaction effect between any two categorical variables

566　and each scale variable. Table 10 displays the significance values between all combinations of

567　three categorical variables and one scale variable. The results show five significance values less

568　than 0.05: Item 4 and JES (0.000); Item 5 and JES (0.000); Item 5 and STS (0.006); Item 8 and

569　JES (0.040); and Item 10 and JES (0.020).

570

571　**Table 10** Significance values between combinations of three categorical variables and one scale variable

Item number	Combinations of categorical variables	JES	STS	FS
1	Gender, Age, Occupation	0.332	0.318	0.181
2	Gender, Age, Education	0.550	0.277	0.201
3	Gender, Age, Transport Mode	0.208	0.351	0.180
4	Gender, Occupation, Education	**0.000**	0.075	0.080
5	Gender, Occupation, Transport Mode	**0.000**	**0.006**	0.072
6	Gender, Education, Transport Mode	0.227	0.919	0.896
7	Age, Occupation, Education	0.272	0.458	0.709

8	Age, Occupation, Transport Mode	**0.040**	0.358	0.358
9	Age, Education, Transport Mode	0.331	0.737	0.864
10	Occupation, Education, Transport Mode	**0.020**	0.380	0.147

In section 4.2.1, the results from the ANOVA show that gender, age, occupation, and education are unrelated to journey experience, while the combination of gender, occupation and education in Item 4 can strongly affect JES as its significance value is less than 0.05. In addition, although JES may be affected by transport mode, and STS may be affected by transport mode and education respectively, combining other categorical variables with transport mode or education has no effect on JES or STS. For example, the significance value between Item 6 (gender, education, transport mode) and STS is 0.919, which is much larger than 0.05. Therefore, the interaction effect can affect the relationship between categorical variables and scale variables, and the interaction effect cannot be determined via the ANOVA. Section 4.2 reveals that some factors are related to the commuting experience and hedonic well-being (Table 11).

Table 11 The relationship between categorical variables and scale variables

Factors	Commuting Experience	Hedonic Well-being
Education	/	√
Transport mode	√	√
Gender, Occupation, Education	√	/
Gender, Occupation, Transport Mode	√	√
Age, Occupation, Transport Mode	√	/
Occupation, Education, Transport Mode	√	/

According to the results, eudaimonic well-being, measured by FS, cannot be influenced by

33

585　any individual categorical variable or combination of multiple categorical variables. To

586　determine whether these factors can influence eudaimonic well-being by affecting journey

587　experience and hedonic well-being, the next section explores the relationship between JES, STS,

588　and FS.

589　4.3 Analysis of the relationship between journey experience, hedonic well-being, and

590　eudaimonic well-being

591　　To determine the relationship between the journey experience, hedonic well-being and

592　eudaimonic well-being, the linear regression method and regression curve method were applied.

593　Table 12 summarises the results of the three regressions. All three significance values are less

594　than 0.05; thus, close relationships exist between the journey experience and hedonic well-

595　being; between journey experience and eudaimonic well-being, and between hedonic well-

596　being and eudaimonic well-being. Furthermore, all β_1 values in these three regressions are

597　greater than 0; thus, every two variables in each linear regression have a positive correlation

598　but differ on the degree of correlation and curve fitting. The multiple R value of the third

599　regression has the highest value at 0.85, which means that the strongest positive correlation

600　exists between hedonic well-being and eudaimonic well-being. Correspondingly, the R squared

601　value of this regression (0.71) is the highest; thus, STS and FS fit the linear regression model

602　best. In contrast, the weakest positive correlation exists between journey experience and

603　eudaimonic well-being. Correspondingly, JES and FS are the worst fit for the linear regression

604　model, with the lowest R squared value of 0.18.

605

Table 12 Multiple R and R squared values from the simple linear regression models

Regression	Axis	Variable	Significance value	Slope	Intercept	Multiple R	R squared	Regression curve equation
1	Y	STS	9.14437E-17	0.6745	-0.5435	0.56	0.31	Y = 0.6745X - 0.5435
	X	JES						
2	Y	FS	1.37099E-09	0.5166	37.144	0.42	0.18	Y = 0.5166X+37.144
	X	JES						
3	Y	FS	1.74901E-52	0.8522	37.403	0.85	0.71	Y = 0.8522X + 37.403
	X	STS						

607   Overall, positive correlations exist between the commuting experience and hedonic well-

608   being; between the commuting experience and well-being; and between hedonic well-being and

609   eudaimonic well-being. Therefore, although none of the categorical variables or combinations

610   is related to eudaimonic well-being, there are, nonetheless, factors that may be indirectly

611   associated with eudaimonic well-being because they are directly related to the journey

612   experience or hedonic well-being. The analysis presented in the previous section has suggested

613   that the choice of different transport modes can affect the journey experience, hedonic well-

614   being and eudaimonic well-being. The impacts of transport modes on journey experience and

615   well-being are further examined below.

616   4.4 Impacts of transport modes on journey experience, hedonic well-being and eudaimonic

617   well-being

618   Table 13 and Figure 2 display the average values of the three scale variables for different

619   transport modes. To make the comparison clearer, in Figure 3, the range of each FS item has

620   been adjusted from 1~7 to -3~3. Five transport modes were analysed: cars, buses, walking,

621   cycling, and electric bicycles. Compared with other transport modes, respondents who

622   commuted by bicycle were top scorers on all three scales, thus having the most satisfactory

623   commuting experience and the highest levels of well-being. This concurs with Abou-Zeid and

624   Ben-Akiva (2011) and Smith (2013), who found that commuters who cycle and/or walk were

625   more likely to have higher levels of commuting satisfaction. Ma and Ye (2019) also claimed

626   that cycling could produce more significant mental health benefits than walking. In contrast,

627   commuting by car and electric bicycle scored the lowest average values, which is consistent

628   with Ye and Titheridge's (2017) study, showing that electric bicycles are associated with the

629   lowest levels of commuting satisfaction. Although the average values for buses and walking

630   were not as high as for cycling, both have higher average values than cars and electric bicycles.

631

632   **Table 13** Average values on the three scales for different transport modes

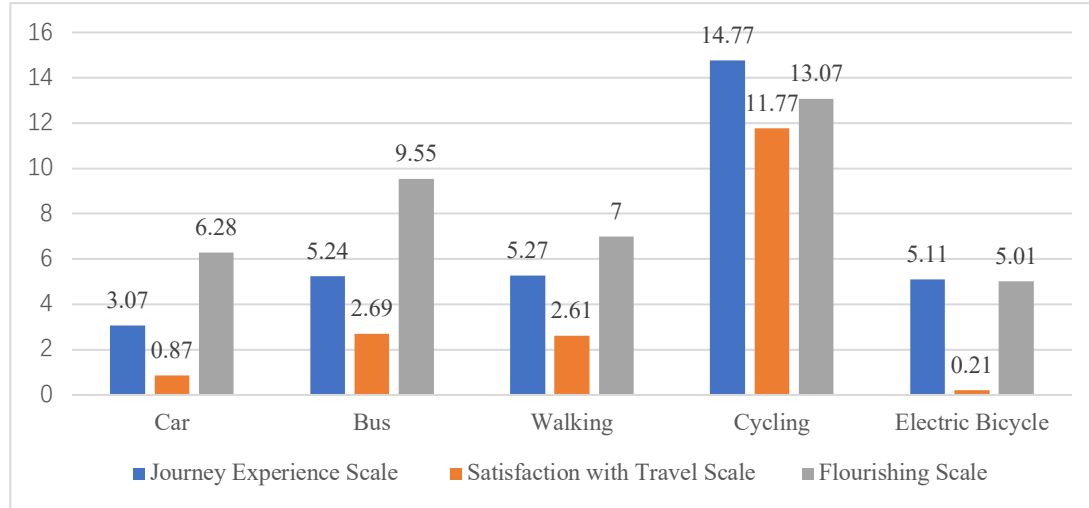| Variables	Transport modes				
	Car	Buses	Walking	Cycling	Electric bicycles
JES	3.07	5.24	5.27	14.77	5.11
STS	0.87	2.69	2.61	11.77	0.21
FS	38.28	41.55	39	45.07	37.01
FS (adjusted)	6.28	9.55	7	13.07	5.01

633

Fig. 2. Average scores on the three scales across different transport modes

636

5. Discussion

Our findings show that, first, commuting mode is related to the journey experience, while both educational attainment and commuting mode are related to hedonic well-being. Second, positive correlations exist between the commuting experience and hedonic well-being; between commuting experience and well-being; and between hedonic well-being and eudaimonic well-being. Furthermore, the strongest relationship is established between hedonic and eudaimonic well-being, while the weakest relationship is between the journey experience and eudaimonic well-being. Therefore, it can be argued that commuting mode is indirectly associated with eudaimonic well-being. Meanwhile, education has an indirect association with the journey experience and eudaimonic well-being. Previous studies conducted by Abou-Zeid and Ben-Akiva (2011), Ye and Titheridge (2017) and Zhu et al. (2019) illustrated the impacts of transport mode on journey experience and hedonic well-being. They argued that level of commuting satisfaction differs according to choice of travel mode. Existing research has shown that certain

650 individual characteristics, such as age, gender and occupation, can influence the journey

651 experience and well-being (Oguz et al., 2013; Stradling et al., 2007; Zijlstra and Verhetsel,

652 2021). However, our study only shows an association between education and commuting

653 experience, and hedonic and eudaimonic well-being. Ryff and Singer (2008) identified a strong

654 positive link between educational attainment and eudaimonic well-being – a link particularly

655 notable in relation to personal growth and life purpose. Zhu et al. (2019) and Zijlstra and

656 Verhetsel (2021) found that the higher a person's level of educational attainment, the higher

657 his/her levels of well-being. The results are also consistent with Ryan and Deci's (2001) views

658 that hedonic well-being and eudaimonic well-being are complementary in some respects.

659 McMahan and Estes (2011a; 2011b) asserted that the eudaimonic dimensions of well-being are

660 more closely related to self-reported well-being and psychological functioning than the hedonic

661 dimensions. This study explores the relationship between hedonic well-being and eudaimonic

662 well-being, but also shows that the commuting experience is positively correlated with

663 eudaimonic well-being.

664 Furthermore, the results have revealed that the journey experience is related to four

665 combinations of variables: 1) gender, occupation and education; 2) gender, occupation and

666 transport mode; 3) age, occupation and transport mode; 4) occupation, education and transport

667 mode. However, according to our research, hedonic well-being is only related to the following

668 combination: gender, occupation and transport mode. None of the combinations directly relates

669 to eudaimonic well-being. Considering the interaction effect between relevant factors that

670 impact on well-being, Zijlstra and Verhetsel (2021) argued that age, educational attainment and

671   other relevant variables are likely to affect the relationship between income and well-being.

672   Third, our results show that commuting by bicycle is associated with the highest levels of

673 satisfaction with the journey experience and the highest levels of hedonic well-being and

674 eudaimonic well-being, followed by walking. This is consistent with studies conducted by

675 Abou-Zeid and Ben-Akiva (2011) and Smith (2013), showing that those who commute by

676 bicycle and on foot are more likely to have higher levels of commuting satisfaction. Ma and Ye

677 (2019) argued that cycling can offer greater mental health benefits than walking, while Cheng

678 et al. (2020) stated that walking is an important means of promoting health and well-being due

679 to the benefits of an active lifestyle. Our results also show that respondents who commuted by

680 bus tended to have higher levels of satisfaction with the commuting experience and higher

681 levels of well-being compared with respondents who commute by cars and electric bicycles.

682 Cao et al. (2016) maintained that public transport passengers have the highest levels of

683 satisfaction with the metro, followed by BRT and conventional buses. However, Heze is a

684 relatively small-sized city and buses are the only public transport option currently available.

685 Therefore, with the advance of urban growth in Heze, the development of multiple public

686 transport modes could improve citizens' well-being. In addition, well-developed public

687 transport services could reduce private car usage and promote cycling (Meng et al., 2014).

688 Commuting by car is generally associated with a relatively lower level of satisfaction with the

689 commuting experience and of well-being, and this is likely to be exacerbated by the serious

690 traffic congestion in Heze, which lengthens commuting time. Commuters who spend a longer

691 time commuting tend to have lower levels of commuting satisfaction (Choi, Coughlin and

692　　D'Ambrosio, 2013; Zhu et al., 2019; Zijlstra and Verhetsel, 2021). Additionally, our results

693　　show that commuting by electric bicycle is associated with lower levels of satisfaction with

694　　both the journey experience and lowest levels of hedonic and eudaimonic well-being.

695　　　　Findings from practitioner interviews were generally consistent with survey findings. In

696　　terms of commuting modes, active travel and travel by bus are perceived as more likely to

697　　improve the quality of the journey experience and hedonic well-being. In contrast, commuting

698　　by car and electric bicycle is regarded as reducing the quality of the journey experience and

699　　hedonic well-being. However, our study has not identified a causal relationship between

700　　commuting by bicycle, walking or bus and eudaimonic well-being. In addition, the individual's

701　　conception of eudaimonic well-being leads him/her to undertake corresponding eudaimonic

702　　activities. Furthermore, eudaimonic activities related to self-development and contribution to

703　　society can result in positive subjective experiences and experiencing increased meaning in life,

704　　resulting in higher levels of well-being (Diener and Lucas, 1999; Waterman, 2005). Our study

705　　suggests that respondents with higher levels of eudaimonic well-being tend to walk, cycle or

706　　travel by bus due to their conception of well-being; commuting on foot, by bicycle or by bus is

707　　regarded as a positive eudaimonic activity, producing higher levels of eudaimonic well-being.

708　　Based on the combined results of practitioner interviews and questionnaires, it is evident that

709　　current transport issues in Heze, such as limited choice of transport modes (buses only), are

710　　likely to lead to lower levels of satisfaction with the journey experience and lower levels of

711　　well-being, while transport development opportunities, such as policies and planning designed

712　　to promote and implement sustainable forms of transport, could improve quality of journey

713   experience and well-being. Therefore, the mixed methods approach effectively enables a better

714   linkage to be established between transport issues perceived by policymakers and transport

715   planners, and the demands of users (Liu et al., 2020; Lyu et al., 2020).

716   The results obtained from this case study can be compared with those for other cities. For

717   example, our findings echo what was found in Ye and Titheridge's (2017) research in Xi'an,

718   which showed that commuting mode influences both journey experience and hedonic well-

719   being, and commuting by electric bicycle is associated with the lowest levels of satisfaction in

720   these areas. In addition, Smith (2013) found that commuters in Portland who cycled and walked

721   have higher levels of commuting satisfaction than those who commute by other travel modes,

722   which corresponds with the results obtained from Heze. However, Zhu et al. (2019) examined

723   124 Chinese cities and found the opposite: those who commute by walking or cycling are likely

724   to experience lower levels of SWB. This could be due to the poor quality of pavements and

725   bicycle lanes, lack of safety measures, and traffic pollution.

726   Exploring transport mode's contribution to well-being is beneficial for policymakers

727   needing to meet increasing demands for social well-being and health rather than basing policy

728   merely on economic indicators (Singleton and Clifton, 2021). In this study, a new method

729   combining measurements of aspects of commuting experiences was used, in terms of hedonic

730   well-being and eudaimonic well-being, to explore commuting satisfaction. Measurements of

731   hedonic and eudaimonic well-being used in the commuting domain can also provide relevant

732   information for future development and management strategies. Combining the Satisfaction

733   with Travel Scale (STS) (Ettema et al., 2011) and the Flourishing Scale (Diener et al., 2010)

734   represents a new approach to measuring overall well-being, which contains elements of both

735   hedonic and eudaimonic well-being, thereby helping to achieve expectations for further studies

736   referred to by De Vos et al. (2013), as well as assisting practitioners and policymakers in

737   designing strategies to promote travellers' well-being and that of commuters in particular. It

738   might be argued that there is no significant difference between journey experience and hedonic

739   well-being (travel satisfaction) and that they could all be identified as travel satisfaction in

740   specific contexts. Several policy implications arise from our findings. First, walking and cycling

741   have been found to enhance the journey experience (Gatersleben and Uzzell, 2007; Legrain,

742   Eluru and El-Geneidy, 2015) and contribute to the hedonic (Abou-Zeid and Ben-Akiva, 2011;

743   Smith, 2013) and eudaimonic well-being (Vaitsis, Basbas and Nikiforiadis, 2019) of

744   commuters/travellers, in line with our results. Encouraging active travel to improve residents'

745   journey experiences and well-being is essential. Policy actions aimed at increasing active travel

746   should focus more on travellers' safety, comfort and route quality to reduce commuting stress

747   and increase travel satisfaction (Chatterjee et al., 2020; Vaitsis, Basbas and Nikiforiadis, 2019).

748   Therefore, local government sectors with responsibility for transport should extend and

749   accelerate the construction of infrastructure to facilitate and cater for active travel (e.g.,

750   pedestrian and cycle lanes). Cheng et al. (2019), Ma and Ye (2019) and Meng et al. (2014)

751   proposed similar methods, such as investing in dedicated cycle and pedestrian lanes, and

752   encouraging compact community design through connected streets and mixed land use.

753   Furthermore, bike-sharing systems can provide a flexible and convenient transport mode for

754   short trips, particularly for the first/last mile (Cheng et al., 2020; Lyu et al., 2020; Zhang et al.,

755   2021; Zhang and Meng, 2019). Second, development of urban public transport within

756 comprehensive urban planning should be prioritised. Delays in commuting time result in

757 unpleasant commuting experiences, reducing levels of hedonic well-being. Therefore, policy

758 actions should focus on improving the service quality of public transport to reduce commuting

759 time while increasing predictability (Chatterjee et al., 2020). Zhang, Wang and Meng (2018)

760 claim that public transport development is one of the most effective ways to reduce urban traffic

761 congestion. For instance, accelerating the construction of urban rail transit, bus lanes and BRT

762 systems can provide an alternative to car travel in urban areas. Cao and Cao (2017) argue that

763 transit operators should consider reliability of services and people's comfort while waiting at

764 the station/stop. Third, alerting the public of green transport options can reduce private car

765 usage, particularly in urban areas in relatively small cities. Transport demand management, such

766 as restrictions on car purchases and restricted driving zones, could help reduce excessive car

767 use and alleviate traffic congestion (Cao, 2021; Cheng et al., 2019). In short, policy implications

768 should primarily focus on three aspects: enhancing the commuting experience (increasing

769 predictability of public transport to reduce commuting stress and promoting an

770 environmentally-friendly commuting environment); enhancing commuting satisfaction in

771 terms of both hedonic and eudaimonic aspects (promoting active travel and improving the

772 service quality of public transport); and reducing the negative impacts of long commutes

773 (managing congestion and crowding and reducing car usage).

774

6. Conclusion

776   The relationship between commuting and well-being is a key issue in the field of mobility

777 and transport in both developed and developing countries. In the current literature, there is a

778 scarcity of research on the journey experience and eudaimonic well-being. This study, therefore,

779 examines commuters' experiences and both hedonic and eudaimonic well-being regarding

780 individual characteristics and transport mode, using Heze as a case study. The Journey

781 Experience Scale (JES), the Satisfaction with Travel Scale (STS) and the Flourishing Scale (FS)

782 have been applied to independently measure the journey experience, hedonic well-being and

783 eudaimonic well-being. Using the ANOVA and MANOVA methods, this study has explored the

784 significance values between the categorical variables (age, gender, education, occupation and

785 transport mode) and the scale variables (JES, STS and FS). The results show that educational

786 attainment is related to hedonic well-being, and transport mode is related to both the journey

787 experience and hedonic well-being. Furthermore, we found that some combinations of

788 individual characteristics and transport mode are related to the journey experience and hedonic

789 well-being, but none is related to eudaimonic well-being. Regression models were also applied.

790 We found strong positive associations between the commuting experience and hedonic well-

791 being; between the commuting experience and eudaimonic well-being; and between hedonic

792 and eudaimonic well-being. We also found that commuting by public transport, walking and

793 cycling are more likely to improve the quality of the journey experience as well as hedonic and

794 eudaimonic well-being.

795   It is highly salient for policymakers and transport planners to understand the relationship

796 between the journey experience and hedonic and eudaimonic well-being to formulate and

797 implement practical and forward-looking transport strategies and to balance policy outcomes

798   with residents' travel needs. Furthermore, individual characteristics and transport modes

799   associated with travel behaviour have presented significant challenges in terms of urban

800   planning and infrastructure development. Policies designed to promote travel satisfaction in the

801   future should also focus on promoting active travel (walking and cycling) and public transport.

802   This study has limitations. First, the sample size is relatively small and could be increased

803   in future studies. Second, some studies have recently explored the non-linear associations

804   relating to travel satisfaction (Fang, et al., 2021; Sun, Fang and Cao, 2020; Wu, Cao and Ding,

805   2020). Therefore, in future research, non-linear models could also be applied to examine the

806   relationship between the commuting experience and hedonic and eudaimonic well-being.

807

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