WORKING PAPER

ITLS-WP-26-09

Valuing the eudaimonic wellbeing benefits of land use transport measures

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May 2026

ISSN 1832-570X

INSTITUTE of TRANSPORT and LOGISTICS STUDIES

The Australian Key Centre in Transport and Logistics Management

The University of Sydney

Established under the Australian Research Council's Key Centre Program.

NUMBER: Working Paper ITLS-WP-26-09

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ABSTRACT: Benefit measurement for locally-focused land use transport interventions is often narrow. The ultimate purpose of such interventions is often improved citizen wellbeing, yet this is seldom measured or monetized. Adding such valuation provides a way to more comprehensively reflect the value of associated interventions. Subjective wellbeing measurement is broadly divided between hedonic and eudaimonic streams, benefit monetization focusing on the value of changes in life satisfaction (part of hedonic wellbeing). While improving life satisfaction might have initial value, this might not be sustained if eudaimonic wellbeing is not concurrently promoted, suggesting land use transport policy/planning should take a broader view of what it means for people to be 'well' than is embedded in life satisfaction. However, no values have been identified for changes in levels of eudaimonic wellbeing, partly because of lack of agreement about how to best measure eudaimonic wellbeing. To address this monetisation gap, the paper develops a value for changes in eudaimonic wellbeing, measured using Ryff's (1989) Scale, and explores implications for valuing wellbeing as life satisfaction. The resulting eudaimonic wellbeing values are likely to be particularly useful for evaluating land use/transport initiatives with a local focus, such as walking and place-making improvements, but the monetised values are more broadly applicable. Literature implied that changes in eudaimonic wellbeing may have higher monetized value than changes in life satisfaction, because of the broader societal connections embedded within eudaimonic wellbeing, an expectation confirmed in the analysis, highlighting the policy importance of eudaimonic wellbeing.

KEY WORDS: ***Eudaimonic wellbeing, hedonic wellbeing, monetized values of wellbeing change, life satisfaction, cost benefit analysis***

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ACKNOWLEDGEMENTS: This research has been supported by the Institute of Transport and Logistics Studies and The University of Melbourne and is not associated with any other organisation. Dianne Vella-Brodrick wishes to thank the Higgins family for supporting her role as Gerry Higgins Chair in Positive Psychology.

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DATE: May 2026

1. Introduction

Over the past two decades, several factors have come together to stimulate research on measures of subjective wellbeing and on how public policy making might improve wellbeing (O'Donnell et al. 2014; OECD 2013; Stiglitz et al. 2009). Application of monetized wellbeing values in public policy and project appraisal is one prospective outcome of such efforts, extending benefit/cost valuation coverage of tools such as cost-benefit analysis (CBA) (Department for Transport (DfT) 2024; HM Treasury and SITF 2021; O'Donnell et al. 2014).

At the most basic level, the philosophical origin for wellbeing valuation is grounded in the idea that public policy should ultimately be about improving societal wellbeing and that societal wellbeing is some aggregation of the wellbeing of those in that society. Issues like distributional equity and measurement of effects need to be handled in this approach (Hausman and McPherson 2006; Sen 2009). Being able to measure various impacts on wellbeing, and other outcomes, in money terms, then enables an overall assessment of a range of policy alternatives to be formed, such that impacts might potentially be traded-off against one another, to form a view about the best way forward.

Subjective wellbeing measurement and analysis is broadly divided between three streams (Diener 1984; OECD 2013): (1) evaluative or self-assessed subjective wellbeing, typically assessed using general life satisfaction or domain specific satisfaction measures; (2) affective wellbeing, which is an assessment of positive and negative emotional states; and (3) eudaimonic wellbeing, also called psychological wellbeing (e.g., Ryff 1989), which refers to living a life filled with purpose and meaning, a desire to grow and develop to one's full potential and being pro-social and other-focused. The first and second streams are sometimes known as hedonic wellbeing.

The UK report on *Wellbeing and Policy* (O'Donnell et al. 2014) argued that all subjective wellbeing streams are important for policy purposes. This seems relevant as it has been argued that these wellbeing streams may overlap (Kashdan et al. 2008) or produce synergistic effects where there is likely to be bi-directional reinforcement for heightened and sustained wellbeing effects (Huta and Ryan, 2010).

Monetization of the value of a unit change in wellbeing has developed primarily within the hedonic stream, focusing on life satisfaction, where the pioneering efforts of authors such as van Praag and Ferrer-i-Carbonell (2004) are notable. However, there has been little progress in monetizing changes in affect or eudaimonic wellbeing (HM Treasury and Social Impacts Task Force 2021). Initial efforts to address this gap were made by Stanley et al. (2021). They developed Australian monetised values for changes in positive affect and for two of the six components of Ryff's (1989) Psychological Wellbeing Scale (personal growth and positive relations with others) but monetised values for a comprehensive measure of eudaimonic wellbeing could not be identified.

There is a small but growing evidence base about how changes in the built environment, including transport, might affect various aspects of health and wellbeing but eudaimonic wellbeing is not a major focus of that work, with some exceptions (e.g., Cuignet et al. 2020; Du and Sun 2024; Mouratidis 2020, 2021; OECD 2023). A more extensive evidence base exists about connections between nature and eudaimonic wellbeing (e.g., Bratman et al. 2019; Capaldi et al. 2014; Järekari et al. 2025). However, the lack of monetary values for anything other than wellbeing as life satisfaction is a barrier to a fuller understanding of how wellbeing in all its guises might be enhanced by public policy, including land use transport policy interventions.

The land use transport policy and planning focus at community/neighbourhood level has increased in recent years, including approaches such as strong/complete communities, complete streets,

movement and place, 15- or 20-minute neighbourhoods and transit-oriented communities (e.g., Haque et al. 2025; Mouratidis 2020, 2021; Stanley et al. 2023). We expect monetary values for eudaimonic wellbeing to be particularly useful for evaluating the worth of land use transport policy interventions at this scale, including active travel and place-making initiatives. The wider societal focus of eudaimonic wellbeing measures seems well suited to such contexts, relative to measures of life satisfaction, as outlined in Section 2. However, impacts on eudaimonic wellbeing are not included within standard UK, Australian or other CBA appraisal guidelines.

The current paper extends the wellbeing monetisation research by Stanley et al. (2021), to derive what we believe are the first monetized estimates of the value of changes in overall eudaimonic wellbeing, encompassing all six of Ryff's (1989) component measures of eudaimonic wellbeing. This will help to narrow the wellbeing valuation gap and enable a fuller assessment of how land use transport policy and project interventions might enhance wellbeing.

This paper sets out current understandings of subjective wellbeing in Section 2, illustrating some applications relevant to land use transport policy and planning. Section 3 describes the methods used in the paper to estimate monetized values for unit changes in both life satisfaction and eudaimonic wellbeing, with results detailed in Section 4. Section 5 discusses these results and Section 6 presents the paper's conclusions. A key aim of the paper is to stimulate discussion in the land use transport policy and research communities about the importance of monetising the value of changes in eudaimonic wellbeing and of circumstances where those wellbeing values may be appropriate in CBA applications.

2. Literature review

2.1 Hedonic and eudaimonic wellbeing

The field of positive psychology has evolved from an initial focus on hedonic aspects of wellbeing, largely seen as being about experiences, encompassing life satisfaction/evaluative wellbeing and affective (positive and negative) components, to a more comprehensive approach that incorporates both hedonic and eudaimonic elements (Vella-Brodrick 2016). The eudaimonic component is mainly about growth, meaning, relationships and being true to oneself, as well as functioning well (Huta and Waterman 2014). Ryff, Boylan and Kirsch (2021) argue that eudemonic wellbeing draws on an extensive history of what it means to be well, reflected in Ryff's (1989) six dimensions of eudaimonic wellbeing: self-acceptance, positive relations with others, autonomy, environmental mastery, purpose in life and personal growth. Some degree of overlap between the hedonic and eudaimonic conceptions of wellbeing is usually recognized (Huta and Ryan 2009), with Disabato et al. (2016) even suggesting that this overlap is sufficiently strong empirically for wellbeing to be seen as a single construct. They acknowledge, however, that "measures of eudaimonia may contain aspects of meaningful goal-directedness unique from hedonia" (Disabato et al. 2016, p. 471).

This shift in focus in positive psychology, beyond the hedonic stream, occurred as researchers recognized that targeting only hedonic aspects could lead to adverse effects, such as the 'hedonic treadmill', where individuals constantly seek increasing amounts of pleasure to maintain the same level of satisfaction (Diener et al., 2006). While hedonic experiences can be highly enjoyable and contribute to broadening and building personal resources (Fredrickson, 2004), they are not sufficient for lasting happiness and optimal functioning (Vella-Brodrick, 2016). Eudaimonic wellbeing, on the other hand, encompasses higher-level qualities such as personal growth, life meaning, self-realisation, and the fulfillment of one's potential. Eudaimonic approaches emphasise living in accordance with one's true self and values, engaging in meaningful activities, and contributing to the greater good.

Research has shown that both hedonic and eudaimonic aspects of wellbeing are important for a full and satisfying life. For example, Peterson et al. (2005) identified three distinct pathways to happiness: pleasure, engagement, and meaning. They found that individuals who pursued all three pathways reported the highest levels of life satisfaction, with engagement and meaning being especially critical. Individuals may experience a mix of hedonic and eudaimonic elements simultaneously, and activities can contribute to both aspects of wellbeing. This perspective can at least partially explain the argument that theoretically these types of wellbeing may seem distinct but empirically they can overlap, as found by Disabato et al. (2016), Huta and Ryan (2010) and Mise and Busseri (2020).

Baumeister, et al. (2013) came to similar conclusions based on their study which compared predictors of (a) being happy (hedonia) and (b) finding life meaningful (eudaimonia). They found that although some overlap was evident, there were also some notable differences. A key difference relating to time perspective was found, with happiness associated with a 'right now' orientation and meaningfulness being linked with a synthesis of the past, present and future. Furthermore, happiness was associated with taking rather than giving, while meaningfulness was related to giving rather than taking. Huta and Ryan (2010) also found that eudaimonic pursuits were associated with higher level experiences including connection with a greater whole, including being linked to greater levels of caregiving behaviours and concern for future generations. This finding directly supports the idea that eudaimonic wellbeing promotes prosocial behaviour and concern for others, qualities that would be valued by society.

These developments have led to a greater focus on more comprehensive frameworks and measures of wellbeing that incorporate both hedonic and eudaimonic elements. Examples include the PERMA model (Seligman, 2011), which comprise positive emotions, engagement, relationships, meaning, and accomplishment, and the Ryff Scales of Psychological Well-Being (Ryff, 1989), with its six dimensions of eudaimonic well-being noted above. What is noteworthy across these various studies is that both eudaimonia and hedonia have important roles to play, with some different outcomes and, thus, it is argued here that there is a need to have an economic value associated with both eudaimonic wellbeing and hedonic wellbeing.

2.2 Transport and eudaimonic wellbeing

There is a growing literature on connections between transport and wellbeing, often related to satisfaction with various aspects of travel, sometimes separating effects related to destination activities, travel activities and the travel experience (Chatterjee et al. 2020; Mokhtarian and Salamon 2001; Singelton 2017). This satisfaction stream includes the development and use of a Satisfaction with Travel Scale (Ettema et al. 2011). However, there has been much less focus on associations between travel and eudaimonic wellbeing, with De Vos et al. (2013) and Mokhtarian (2019) noting the importance of transport research going beyond hedonic views (of pleasure and satisfaction). This gap in the wellbeing focus of transport research is possibly attributable to the lack of an agreed definition of, and means of measuring, eudaimonic wellbeing. For example, Ruini and Cesertti (2019) found that Ryff's (1989) Psychological Wellbeing Scale was the most commonly used way of measuring eudaimonic wellbeing in applied research on depression but they identified 16 different measurement instruments used across a range of studies.

Nordbakke and Schwanen (2014) argued that the direct relationships between transport initiatives and eudaimonic wellbeing are unclear. In relatively early research in this area, Delbosc (2012) found that increased transport mobility provides individuals with opportunities for meeting basic psychological needs. Using the same Victorian (Australia) data set, Vella-Brodrick and Stanley (2013)

found that transport can assist people to have positive relationships and function effectively, to achieve personal goals within their environment.

Using a case study in Thessalonika, Vaitsis et al. (2019) examined how eudaimonic wellbeing affects mode choice. Their indicators of eudaimonic wellbeing were related to comfort, safety, autonomy, self-confidence, physical and mental health, their analysis concluding that these factors had a significant role to play in mode choice decision-making.

Cuignet et al. (2020) explored associations between *mobility*, decomposed into dimensions related to motility (the potential for movement) and movement per se, and *wellbeing*, encompassing both hedonic and eudaimonic components, recognizing there may be overlap between these wellbeing conceptions. Their Luxembourg case study of older adults found that improving motility is positively related to eudaimonic wellbeing and, to a lesser extent, to hedonic wellbeing. Their research suggests that changing local physical features of cities and neighbourhoods – such as by improving access - is important for enhancing movement and eudaimonic wellbeing of older persons, highlighting empowerment gains and progressing sustainable and equitable motility. Importantly, they argue that "... shifting the focus from travel satisfaction (and largely hedonic wellbeing) to the eudaimonic parts of wellbeing seems key to future planning actions" (Cuignet et al., p. 397)

Du and Sun (2024) point to the lack of research examining how transport improvements affect a comprehensive measure of eudaimonic wellbeing, such as Ryff's (1989) Psychological Wellbeing Scale. They used Ryff's (1989) scale to explore how a new metro line affected the wellbeing of older people, finding that three of Ryff's six eudaimonic wellbeing dimensions (environmental mastery, purpose in life and self-acceptance) were promoted by the new metro. They argued that this finding provides an opportunity to counteract the usual age-related decline in eudaimonia observed amongst older adults.

Reflecting the growing interest in connections between nature and wellbeing (Bratman et al. 2019, Capaldi et al. 2014), Järekari et al. (2025) explore how nature can facilitate improved eudaimonic wellbeing. They found that both youth (15-24) and elderly (60+) citizens in the mid-sized Nordic city they studied gained notable eudaimonic wellbeing benefits from urban nature. Travel opportunities can be important in the capacity to realize such benefits, such as by taking a walk to appreciate the beauty of nature or undertaking travel to/from opportunities to achieve this benefit, reflecting some of the ways of approaching travel-wellbeing perspectives identified in the life satisfaction-based approach (i.e., destination activities, travel activities, the travel experience).

It is noteworthy that the studies by Vaitsis et al. (2019), Cuignet et al. (2020), Du and Sun (2024) and Järekari et al. (2025) do not use the same way of measuring eudaimonic wellbeing. Vaitsis et al. (2019) used indicators for comfort, safety, autonomy, self-confidence, physical and mental health. Cuignet et al. (2020) used seven elements of the 36 Item Short Form Health Survey questions plus the geriatric depression scale and a social index they developed themselves. Du and Sun (2024) and Järekari et al. (2025) used Ryff's (1989) Psychological Wellbeing Scale.

2.3 Other aspects of the built environment and eudaimonic wellbeing

In addition to transport, OECD (2023) emphasizes the importance of other components of the built environment for eudaimonic wellbeing, mentioning housing, land use, and technical infrastructure, the latter referring to factors such as water, sewerage and energy networks. It is argued that good urban planning and the quality of shared spaces promotes personal interactions, thus providing opportunities to develop eudaimonic wellbeing and inclusion (Makaremi et al. 2025; Sirowy 2024). However, the built environment and its association with eudaimonic wellbeing has not received a lot of case study attention and, according to Dovjak and Kukec (2019), relies more on theory than

practice. This perspective is supported in a literature review undertaken by Astell-Burt and Feng (2015), which concluded that "reliable evidence on the impact of the built environment on wellbeing, and on the mechanisms that link one with the other, constitutes an important gap in knowledge" (Astell-Burt and Feng 2015, p.22), although their research relied on wellbeing as measured through mental health scales.

Research on the built environment and eudaimonic wellbeing has been largely confined to broad overviews, rather than examination of specific associations and case studies about pathways to improved wellbeing (McDougall et al. 2022; Mahoney 2023). These broad perspectives include walkability, density, spatial configurations, environmental noise, and green areas (Zumelzu and Herrmann-Lunecke 2021).

Some evidence of the impact of the built environment on eudaimonic wellbeing is available from Mouratidis (2020, 2021). Mouratidis (2020) uses the OECD (2013) single question indicator of eudaimonic wellbeing to explore pathways between the built environment and improved subjective wellbeing, finding (for example) that neighbourhood satisfaction has significant positive effects on eudaimonia, and on life satisfaction and happiness. Mouratidis (2020) also finds that commute satisfaction has positive effects, either direct or indirect, on all three components of subjective wellbeing.

As illustrated in Section 2.2, green areas within urban spaces have received research attention in recent years in relation to both hedonic and eudaimonic wellbeing, as well as mental health (McDougall et al. 2024). For example, Saint-Onge et al. (2022) studied 449 park users in Canada, finding that parks offered opportunities for the development of social cohesion, personal growth, and connections with others. Hartig et al. (2014) argues that the benefits of green spaces allow both exposure to nature and the opportunity to connect with nature by promoting the feeling of non-human relatedness. This perspective was found to be important for both hedonic and eudaimonic wellbeing, along with natural space offering an opportunity for social and wildlife interactions and offering purpose, agency and meaning to people (Bell et al. 2018).

2.4 Main findings from literature review

This brief literature overview suggests that there is a growing interest in how the built environment, including transport, can support personal subjective wellbeing, to inform policy making with this intent. However, considerable work is needed to achieve consistency and focus in this work. While life satisfaction, affect and eudaimonic wellbeing are all seen as having contributions to make in terms of better understanding wellbeing, life satisfaction has been the main focus of policy attention, including for land use transport policy development and application. Eudaimonic wellbeing is seen as a longer-term component of wellbeing than affect and life satisfaction and as important for sustained wellbeing gains but the limited case study evidence available about how land use and transport policy might best advance eudaimonic wellbeing is notable. The lack of an agreed measure of eudaimonic wellbeing poses a substantial barrier in this regard, although Ryff's (1989) Scale has some standing as a measure of eudaimonic wellbeing and has been used in some studies of how the built environment, including nature/greenspaces, can impact wellbeing.

In terms of policy/project evaluation, the Introduction noted that only gains/losses in life satisfaction have a recognized monetary value, with eudaimonic wellbeing lacking a monetised measure. To progress use of eudaimonic wellbeing to guide policy development and application, agreement about how to best measure this component of wellbeing and availability of monetary values applicable for changes in eudaimonic wellbeing are both needed.

3. Methods

To estimate a monetised value for a change in life satisfaction, Australian research has used an analytical framework that focusses on policy-relevant factors, or pathways, seen as likely to influence someone's risk of social exclusion, within an urban/regional land use transport (LUT) policy/planning context (Stanley et al. 2011, 2021, 2022a). The following factors, or impact pathway variables, were identified: trips, bridging and bonding social capital, sense of community, three constructs of wellbeing (life satisfaction, affective and eudaimonic) and area socio-economic disadvantage, together with a range of personal characteristics (e.g., gender, age, household income, abilities, household circumstances (e.g., children), personality traits). Significant association between a policy-relevant variable and risk of exclusion enables inference of a monetary value for changes in levels of that policy-relevant variable, as this contributes to reducing exclusion, provided a monetary variable (e.g., household income) is significant in the model. An Australian Research Council Project enabled assembly of the data base to estimate such models.[1]

This modelling approach is not how sources such as HM Treasury and SITF (2021) derive monetised values for changes in life satisfaction. Their approach involves expressing life satisfaction (dependent variable) as a function of household income (or similar construct) and other explanatory variables and inferring a value for wellbeing (life satisfaction) from that relationship. The alternative approach, used herein, infers a monetised value from an assessment of how wellbeing (e.g., life satisfaction) and household income each contribute to achievement of some other outcome, in this case (reducing) risk of social exclusion. One implication of this approach is that the *monetary worth* of a unit change in wellbeing is not dependent on the origin or source of that gain. We argue that the latter is more likely to affect the *size of wellbeing gain* that is achievable from any given source, rather than the unit value of a change in wellbeing from whatever source. If so, then similar values for a unit change in life satisfaction should be expected from the two approaches. The striking similarity between the value for a unit change in life satisfaction estimated this way by Stanley et al. (2021) and the UK value estimated directly (HM Treasury and SITF 2021) confirms this expectation, supporting application of the approach adopted herein.

It should also be noted that the approach to monetisation taken here is similar to how monetary values for transport benefits such as travel time savings have long been estimated, where (for example) mode choice might be the dependent variable, with travel time and income as explanatory variables. The marginal rate of substitution between travel time and income is then the inferred value for travel time savings. Wellbeing (life satisfaction or eudaimonic wellbeing) *could* be treated as a dependent variable and household income as an explanatory variable and value inferred from the estimated relationship. However, we have used the alternative approach, pursuing valuation via risk of social exclusion, because it has the great advantage that several other policy relevant variables can also be modelled and values inferred at the same time (in the same model), such as trips, bridging and bonding social capital, sense of community and level of neighbourhood disadvantage, all handled in a consistent way. Also, and very importantly, if life satisfaction and eudaimonic wellbeing are connected to some degree, as the literature review suggests, then a modelling approach that enables values for both to be estimated in the same model is an advantage. The approach used here enables that estimation.

Data assembly (2008) in the Australian research began with respondents to a household travel questionnaire, respondents (from Melbourne and regional Victoria) then being invited to complete a further home-interview survey. That Melbourne data is also used for the current analysis. Numbers of respondents at high exclusion risk needed supplementation, a special survey being undertaken. In this research, the dependent variable for analysis purposes was a person's risk of social exclusion, measured using five indicators, each with a defined threshold. Those five indicators were income,

[1] Australian Research Council Industry Linkage Program Project LP0669046: Investigating Transport Disadvantage, Social Exclusion and Well Being in Metropolitan, Regional and Rural Victoria

employment status, political activity, social support and participation (Stanley et al., 2011), building on Burchardt et al. (2002b) but modified for Australian circumstances. A respondent's risk of social exclusion was then scored between zero and five, depending on the cumulative number of thresholds passed/failed (0 = lowest risk of exclusion; 5 = highest). For analysis purposes herein, those with 3 or more risk factors were combined into one category, to produce more balanced respondent numbers in each exclusion category.

Wellbeing was measured several ways, the current paper concentrating on life satisfaction and eudaimonic wellbeing. The Personal Wellbeing Index (or PWI; IWG 2013) is used as the measure of life satisfaction, a person's PWI score being derived as the mean of scores on seven 0-10 points domain scales. The seven domains were standard of living, health, life achievement, personal relationships, safety, community connection and future security. Typical Australian mean PWI values are ~7.5/10 (or ~75/100), with the study's urban sample having a mean of 7.1 (Table 1), partly reflecting the intention to ensure good coverage of those at risk of exclusion, who typically have lower wellbeing. An overall rating of satisfaction for "Life as a whole" was also collected but is not part of the core PWI scale used herein.

Eudaimonic wellbeing was measured using Ryff's (1989) measure of psychological wellbeing (PWB), where the current analysis calculates mean PWB scores across a respondent's scores on the six subscales of Ryff's (1989) measure (sample mean = 4.5/6). These sub-scale scores are derived from responses to 42 questions. Example questions are: "I am not interested in activities that will expand my horizons", "In general, I often feel confident and positive about myself" and "People describe me as a giving person, willing to share my time with others." Positive and negative affect were also measured but are not considered in the current paper. They are discussed in Stanley et al. (2021).

In terms of measurement of other important variables used to explain a person's risk of social exclusion, bonding social capital scores were derived as an index from four 6-point scales, relating to frequency of contacts (Never = 1; Less than Once a Year = 2; More than Once a Year = 3; About Once a Month = 4; About Once a Week = 5; Most Days = 6) within close networks (members of your close family; members of your extended family; friends/intimates; neighbours). This produces a potential scoring range of 4–24. Similarly, a person's bridging social capital score was derived as an index, from two 6-point scales that related to the same frequency of contact but with wider networks (work colleagues; people associated with groups in your community), resulting in a possible scoring range of 2–12 for bridging capital. Sense of community was also measured as an index, using responses to the twelve 7-point scale questions from the Sense of Community Scale (McMillan and Chavis 1986). This produced a possible scoring range of from 12–84. Bonding capital, bridging capital and sense of community scores require strong assumptions if they are to be treated as continuous variables. For modelling purposes, therefore, each was converted to a categorical variable, with approximately equal respondent numbers in low, medium and high scoring ranges.

Stanley et al. (2021) argued that modeling of risk of social exclusion should not include more than one indicator of wellbeing at a time, because of possible multi-collinearity concerns. However, using both PWI and PWB mean scores in an exploratory linear regression model to explain risk of social exclusion for the current paper resulted in VIFF factors under 2.4 for both variables, suggesting multi-collinearity is not a major concern.[2] Nevertheless, the correlation coefficient between mean eudaimonic (PWB) and life satisfaction (PWI) scores was 0.671 (P<.001) (N=636), considerably lower than the coefficients reported by Disabato et al. (2016) but still high enough to suggest that the two representations of wellbeing are, to some extent, capturing some common elements in the data set. One way of assessing the presence of an interaction or overlap effect is to estimate a model that

[2] VIFF factors also suggest that multicollinearity is not an issue between other independent variables in the models.

includes a variable accounting for the joint effect of PWI and PWB (i.e., PWI*PWB), as has been applied in the current analysis.

For this analysis, four ordinal regression models were estimated for subsequent monetization purposes, each having risk of social exclusion (as defined above) as its dependent variable but each having a different way of representing wellbeing (other variables being unchanged):

1. Life satisfaction (evaluative wellbeing) only: measured via a person's mean score across seven domains of the Personal Wellbeing Index (or PWI; IWG 2013)
2. Eudaimonic wellbeing only: measured by a person's mean score on Ryff's (1989) six elements of eudaimonic or psychological wellbeing (PWB)
3. PWI and PWB both included, as separate explanatory variables
4. PWI and PWB both included, together with a variable that recognizes some connection between these two measures of wellbeing (PWI*PWB).

4. Results

Table 1 sets out some summary statistics for the Melbourne study sample. The mean number of thresholds for social inclusion that people did not meet was 1.02/5, suggesting that most respondents are at low risk of exclusion. However, 13.4% of the total number of valid Melbourne responses used in the modelling (N=636) were from people who had 3 or more risk factors, suggesting a high likelihood of exclusion.

Table 1: Summary data for Melbourne study sample

Variable	N	Mean	Std Dev	Min	Max
Social exclusion risk level (full sample)	784	1.02	1.00	0	5
PWI mean score (full sample)	784	7.11	1.61	0.25	10
PWI mean score (model runs)	636	6.98	1.67	0.29	10
PWB mean score (model runs)	636	4.53	.55	2.02	5.93
PWI*PWB	636	32.25	9.96	.59	57.36
Children <18 in household	782	1.57	.50	1	2
Age	767	44.36	20.41	15	91
Number of trips per day	784	3.66	2.63	0	15
Household income per day squared	784	72440	81415	6400	230400
Household income per day (full sample)	784	226.33	145.75	80	480
Household income per day (model runs)	636	208.81	138.36	80	480

Table 2 presents the four ordinal regression models that have been estimated (using SPSS version 29.0.2.0 (20)) to enable inference of various monetized wellbeing values. The dependent variable is a respondent's social exclusion index score, as discussed in section 3 above. Household income is included as household income per day squared, to test whether the marginal rate of substitution between wellbeing, trips and other independent variables, and household income is a function of household income level (it is, inversely). The only difference between the four models relates to how wellbeing is measured.

Table 2: Ordinal regression modelling of the association between wellbeing and social exclusion: Beta values (t values in brackets; N=636)

Variable	Model 1: Includes only PWI	Model 2: Includes only PWB	Model 3: Includes both PWI and PWB	Model 4: Includes PWI, PWB and PWI interacted with PWB
Age	.000 (.03)	-.002 (-0.36)	.001 (-0.11)	.000 (.00)
Number of trips	-.063 (-2.03)	-.058 (-1.88)	-.060 (1.92)	-.060 (=1.93)
PWI7 (Mean)	-.284 (-4.98)	na	-.178 (-2.57)	-.764 (-2.08)
PWB (Mean)	na	-.844 (-5.09)	-.548 (-2.74)	-1.456 (-2.43)
PWI*PWB	na	na	na	.135 (1.63)
Household income per day squared	-1.038e-5 (-7.56)	-1.047e-5 (-7.63)	-1.020e-5 (-7.41)	-1.012e-5 (-7.38)
Number aged <18 in household	.576 (2.81)	.687 (3.35)	.636 (3.08)	.610 (2.94)
Bonding capital - Low	1.075 (4.95)	1.151 (5.33)	1.069 (4.91)	1.079 (4.95)
Bonding capital - Medium	.257 (1.23)	.348 (1.67)	.280 (1.33)	.300 (1.43)
Bridging capital - Low	1.306 (5.87)	1.255 (5.62)	1.251 (5.59)	1.239 (5.55)
Bridging capital - Medium	.574 (2.74)	.593 (2.83)	.569 (2.72)	.569 (2.72)
Sense of community - Low	.754 (2.99)	.735 (3.37)	.625 (2.81)	.643 (2.89)
Sense of community - Medium	.661 (2.65)	.569 (2.79)	.520 (2.54)	.529 (2.58)
Area socio-economic index - Low	.612 (2.99)	.656 (3.20)	.653 (3.18)	.640 (3.11)
Area socio-economic index - Medium	.278 (1.47)	.334 (1.77)	.314 (1.66)	.309 (1.63)
Sample Type	-.971 (-4.62)	-1.034 (-4.95)	-.962 (-4.57)	-.959 (-4.55)
Threshold parameters				
SocexRed = 0	-1.784 (-2.82)	-3.462 (-3.29)	-3.453 (-3.90)	-7.291 (-2.84)
SocexRed = 1	.443 (0.70)	-1.230 (-1.41)	-1.211 (-1.38)	-5.054 (-1.97)
SocexRed = 2	2.049 (3.23)	.363 (0.42)	.410 0 (0.47)	-3.415 (-1.33)
Model Fitting				
McFadden Pseudo R-Square	.228	.229	.232	.234
Test of Parallel Lines	.159	.211	.210	.322

The modelling explored whether age and gender, often treated as control variables, were significantly associated with risk of social exclusion. Simple bivariate correlation coefficients suggested significant association between each of age (5%) and sex (1%) with the risk of social exclusion variable, but neither was statistically significant once included in the various logit models that were estimated, apart from the age variant, 'numbers aged 15–17 years'. We retained "Age' in the models because it is often expected in models like this but deleted other control variables that were not statistically significant.

We estimated proportional-odds (ordered logit) models in which the dependent variable is an ordered index of **social exclusion risk** with four categories: 0, 1, 2, and 3+ risk thresholds met (higher values indicate greater exclusion risk). Let $Y_i \in \{0,1,2,3\}$ denote the category for individual i. Under the cumulative logit (proportional odds) formulation, the model is:

$$\Pr(Y_i \le k \mid \mathbf{x}_i) = \frac{1}{1+\exp(-(\tau_k - \eta_i))} \text{for } k = 0,1,2,$$

$$\eta_i = \mathbf{x}_i^\top \boldsymbol{\beta}, \text{and } \log \frac{\Pr(Y_i \le k)}{\Pr(Y_i > k)} = \tau_k - \mathbf{x}_i^\top \boldsymbol{\beta}.$$

Here, $\tau_k$are threshold (cut-point) parameters and $\mathbf{x}_i$is the vector of covariates. The **parallel lines** (proportional odds) assumption implies a common slope vector $\boldsymbol{\beta}$across all cumulative logits.

Formally, letting $\mathbf{z}_i$denote the stack of non-wellbeing covariates, and writing β.for the corresponding coefficients, the linear predictors for the four models are:

- **M1:** $\eta_i = \beta_0 + \beta_{PWI}\,\text{PWI}_i + \mathbf{z}_i^{\top}\boldsymbol{\beta}_z$
- **M2:** $\eta_i = \beta_0 + \beta_{PWB}\,\text{PWB}_i + \mathbf{z}_i^{\top}\boldsymbol{\beta}_z$
- **M3:** $\eta_i = \beta_0 + \beta_{PWI}\,\text{PWI}_i + \beta_{PWB}\,\text{PWB}_i + \mathbf{z}_i^{\top}\boldsymbol{\beta}_z$
- **M4:** $\eta_i = \beta_0 + \beta_{PWI}\,\text{PWI}_i + \beta_{PWB}\,\text{PWB}_i + \beta_{INT}\,(\text{PWI}_i \times \text{PWB}_i) + \mathbf{z}_i^{\top}\boldsymbol{\beta}_z$. [1]

All models are estimated in SPSS v29 with the **logit link**; goodness-of-fit and pseudo-R^2 statistics are reported, and full SPSS outputs are provided as **Supplementary Data**.

The explicit cumulative logits are for $k \in \{0,1,2\}$:

$$\log\frac{\Pr(Y_i \le k)}{\Pr(Y_i > k)} = \tau_k - [\beta_{PWI}\,\text{PWI}_i + \beta_{PWB}\,\text{PWB}_i + \beta_{INT}\,(\text{PWI}_i\text{PWB}_i) + \beta_{TR}\,\text{Trips}_i + \beta_{AGE}\,\text{Age}_i + \beta_{CH}\,\text{Children}_i + \beta_{INC2}\,HINC_i^2 + \boldsymbol{\beta}_{SC}^{\top}\mathbf{SC}_i + \boldsymbol{\beta}_{SOC}^{\top}\mathbf{SOC}_i + \boldsymbol{\beta}_{AREA}^{\top}\mathbf{AREA}_i + \beta_S\,\text{SampleType}_i],$$

where $\mathbf{SC}_i$are the bonding/bridging dummies (low/medium; high as reference), $\mathbf{SOC}_i$are the sense-of-community dummies (low/medium; high as reference), and $\mathbf{AREA}_i$are the SEIFA (low/medium; high as reference). Some terms are not present in all Models. Thresholds $\tau_k$correspond to the reported $[\,\text{SocexRed} = k\,]$cut-points in the SPSS output.

We use the standard score test in all four specifications and the null of parallel lines **is not rejected** for all four **wellbeing** specifications:

- **Model 1 (PWI only):** adds PWI_i(Personal Wellbeing Index; mean of 7 domains, 0–10).
- **Model 2 (PWB only):** adds PWB_i(Ryff psychological wellbeing; mean over 6 subscales, 0–6).
- **Model 3 (PWI + PWB):** includes both $\text{PWI}_i$and PWB_i.
- **Model 4 (PWI + PWB + interaction):** adds the product term $\text{PWI}_i \times \text{PWB}_i$to allow for overlap/interaction in the two wellbeing constructs. (This interaction is marginal at ~10%.)

To obtain monetisation output from the ordinal model, let $HINC_i$denote household income per day. Because income enters as $HINC_i^2$, the **marginal utility of income** used for shadow pricing is:

$$\frac{\partial \eta_i}{\partial HINC_i} = 2\,\beta_{HINC^2}\,HINC_i.$$

Hence, the **shadow price (A$/unit)** for a covariate $x$with coefficient $\beta_x$is:

$$\text{Value}(x\text{ unit}) = -\frac{\beta_x}{2\,\beta_{HINC^2}\,HINC_i}.$$

Illustrative examples:

- **Model 1 (PWI only) (A$2008):** Value$(\Delta PWI = 1) = -\frac{\beta_{PWI}}{2\,\beta_{HINC^2}\,HINC_i} = -\frac{-0.284}{2\times(-0.00001038)\times HINC_i}$.
- **Model 4 (PWI + PWB + interaction) (A$2008):** the marginal with respect to PWI is $\beta_{PWI} + \beta_{INT}$ PWB$_i$, so

$$\text{Value}(\Delta PWI = 1) = -\frac{\beta_{PWI} + \beta_{INT}\ \text{PWB}_i}{2\,\beta_{HINC^2}\ HINC_i} = -\frac{-0.764 + 0.135\ \text{PWB}_i}{2 \times (-0.00001012) \times HINC_i}.$$

Analogous expressions apply for Value$(\Delta PWB = 1)$and for other policy-relevant covariates (e.g., **trips per day**), enabling consistent shadow pricing across pathways in the same model. The resulting sample-mean values reported in the paper (e.g., PWI ≈ A$93 in M1; PWB ≈ A$273 in M2; trip values ≈ A$18–21) follow directly from these ratios evaluated at observed $HINC_i$(2008 prices).

The various wellbeing measures are statistically significant in their respective models, except for the interaction variable (PWI*PWB), which is only statistically significant at marginally over the 10% level. The importance of people achieving at least medium levels of bonding social capital for social inclusion is notable across all four models. Bridging capital is supportive of inclusion across a broader range of levels and so is having a strong sense of community. Coming from an area with low socio-economic status is likely to increase risks of exclusion, while increased trip making is likely to reduce those risks. This is expected, as trips are an indicator of engagement in activities, which suggests social inclusion.

The resulting mean inferred monetized values for PWI and PWB across the various models are set out in Table 3. The mean value of trips undertaken is also shown for each model, being particularly relevant for evaluating many transport initiatives, including initiatives intended to reduce social exclusion.

Table 3: Monetized values of wellbeing (A$2008 prices)

Wellbeing variable and model	Sample mean monetized wellbeing value for a unit change	Sample mean value of trips in corresponding model
PWI Model 1 (PWI only)	93	20.55
PWI Model 3 (PWB included in model)	59	19.90
PWI Model 4 (PWB included plus PWI*PWB)	51	20.05
PWB Model 2 (PWB only)	273	18.75
PWB Model 3 (PWI included in model)	181	19.90
PWB Model 4 (PWI included plus PWI*PWB)	166	20.05

Model 1 includes only PWI as an explanatory wellbeing variable, producing a mean inferred monetized value of $93 per unit change (A$2008), consistent with previous estimated values of around A$100 (Stanley et al. 2021, 2022a; Stanley and Stanley 2023). Model 2 shows a considerably higher inferred value for a unit change in PWB, at A$273. When both PWI and PWB are included in the same model (Model 3), the inferred value of each declines by around one third, with the monetized PWI value declining marginally more than that for PWB. Model 4 then shows that adding

the interacted variable (PWI*PWB), to recognise that the two conceptions of wellbeing are connected to some extent, further reduces the monetized values of a unit change in both measures of wellbeing: to A$51 for PWI, with a smaller relative adjustment downwards to the inferred value of a unit change in PWB to A$166 (A$2008 prices). However, the interacted variable (PWI*PWB) in Model 4 is only statistically significant at just over 10% level. Because of the way that the models are formulated, the inferred monetary values increase in proportion to decreasing household income. Stanley et al. (2022a) also show that values can be inferred for people with different levels of risk of social exclusion.

As a sensitivity test, the single item question on satisfaction with life as a whole was used to replace the more comprehensive seven domain PWI measure. The single item question is commonly used in monetization of the value of changes in life satisfaction, such as in the UK. Compared to the Model 1 value, this change resulted in a halving of the inferred value of a unit change in life satisfaction, a substantial reduction.

Table 3 also shows the inferred value of one more/less trips from each of Models 1 to 4. Those values remain stable within the A$18-21 range (A$2008 prices) across these various models. This mirrors prior findings by Stanley et al. (2011, 2021, 2022).

5. Discussion

This analysis has used a social exclusion lens through which to pursue wellbeing monetisation. Hedonic wellbeing has been measured herein as life satisfaction, using the 7-domain PWI measure (IWG 2013), while eudaimonic wellbeing has been measured based on the average score across Ryff's (1989) 6-item measure of psychological wellbeing (PWB), which draws on answers to 42 component questions. Model 1 results confirm previous Australian estimated values for a unit change in PWI, with the $93 value (2008 prices) estimated in Model 1 equating to 44.4% of mean sample household income. This is remarkably close to UK values for a unit change in life satisfaction, relative to household income (HM Treasury and SITF 2021; Fujiwara and Dass 2021).

The further three models in Table 2 highlight the importance of eudaimonic wellbeing (PWB), with high inferred monetary values (Table 3). This high inferred value for PWB, as compared to the value for a unit change in PWI, will be partly due to the smaller scale range for PWB (0-6) than for PWI (0-10). In other words, ceteris paribus, it will be more difficult to achieve a one unit increase in PWB than in PWI, so a higher inferred monetized value for a unit change in PWB is no surprise. However, the scale of difference between the two monetized values suggests that eudaimonic wellbeing may be particularly important for wellbeing, in line with the expectation arising from the literature review in Section 2.

The reduction in the inferred monetised value for changes in life satisfaction, measured over seven domains (PWI), once eudaimonic wellbeing is included as an influence on risk of social exclusion, underlines the importance of better understanding the roles and significance of both forms of wellbeing and highlights the need for further studies that explore the monetised value of eudaimonic wellbeing. The literature review underlined that both forms of wellbeing are important. Once eudaimonic wellbeing, as measured herein, is included in modelling, the research suggests that current inferred values for changes in life satisfaction may be too high and constitute too narrow a view of wellbeing for evaluation purposes.

The recognition of potential monetized wellbeing benefits from both PWI and PWB, as compared to just PWI, substantially increases the potential benefit value that is achievable from land use transport policy and project initiatives intended to increase wellbeing. Thus, while Model 1 suggests a potential unit wellbeing gain in PWI is worth A$93 (2008 prices), which aligns with current practice, Models 3

and 4 suggest the potential monetised unit benefits from increased wellbeing might be considerably higher, at A$217-240 if unit benefits from both PWI and PWB are achievable.

As found by Baumeister et al. (2013) a focus on what is meaningful - a major component of eudaimonic wellbeing - is likely to result in sustained positive outcomes due to a more balanced time perspective that transcends a 'right now' mentality associated with hedonic wellbeing, and includes a past and future orientation. Furthermore, eudaimonic wellbeing, with its emphasis on purpose, personal growth, and self-awareness, encourages individuals to engage in meaningful activities that contribute to their long-term development and integration into society. This active engagement is crucial for strong communities and social inclusion, as it fosters a sense of belonging and contribution, unlike hedonic wellbeing which tends to be more self-focused and taking from others rather than giving and doing things for the benefit of others (Baumeister et al., 2013).

While both hedonic and eudaimonic wellbeing are important, the characteristics of eudaimonic wellbeing make it particularly valuable for promoting sustainable and meaningful social engagement and inclusion. Its focus on personal growth, meaningful engagement, and the development of skills and relationships provides a stronger foundation for individuals to overcome barriers to inclusion and actively participate in society.

More broadly, this research raises questions about the capacity of responses to a single question measure to adequately represent wellbeing. This concern was raised by O'Donnell et al. (2014) in relation to single item measurement of eudaimonic wellbeing. The analysis presented herein suggests this concern is equally relevant to monetization of changes in life satisfaction. The inferred monetized values for changes in life satisfaction calculated herein differ substantially between the two measures that were used: one derived from the authors' preferred seven domain measure of PWI and the other inferred from answers to a single life satisfaction question. The seven-domain measure seems likely to be a more robust way of looking at life satisfaction, albeit that it will be more costly to collect the requisite data and hence less likely that it will be widely used for informing public policy development.

From a transport economics perspective, the inferred trip values estimated herein are consistent with previous values estimated by Stanley et el. (2011, 2021, 2022a). These values remain far higher than the inferred value of additional/fewer trips that results from using the traditional economists' rule-of-a-half for valuing such trips. The difference amounts to a factor of around three to four times (Stanley et al. 2022a). Stanley and Stanley (2023) argue that this difference is because the trip values inferred in this research stream include an allowance for both the value of an additional trip to the trip maker, which might be valued by the rule-of-a-half, plus an inferred value for the societal savings in external costs of social exclusion that flow from those additional trips, such as savings in justice, welfare and health system costs. Including these trip values in CBA can make a substantial difference to the resulting benefit-cost ratio for major transport projects that are intended to reduce mobility-related social exclusion (Stanley et al. 2022b).

Using monetized values as derived herein for policy/project evaluation purposes assumes causality between the influencing variables and risk of social exclusion. Stanley et al. (2021) addressed this question, recognising that, though social exclusion and wellbeing are related, the direction of the relationship is not necessarily conclusive, which can introduce bias into parameter estimates. This is a common challenge with cross-sectional data, as used herein. Stanley et al. (2021) argued that a certain level of wellbeing is likely to be needed to take up opportunities, an idea supported by the 'broaden and build' theory of wellbeing (Fredrickson 2004), which seems particularly relevant if people are likely to be at higher risk of exclusion. In line with this thinking on directionality, Diener and Chan (2011) reviewed eight types of evidence that point to a causal connection going from subjective wellbeing to health and longevity. Also, econometric testing of directionality for Stanley et

al. (2021) indicated that wellbeing influencing social exclusion was a statistically significant association, whereas social exclusion influencing wellbeing was not (95% confidence level). Importantly, monetised values for life satisfaction derived from this modelling align very closely with UK values estimated directly from a relationship between income and life satisfaction, providing comfort for using the various monetised values derived herein.

Conclusions

For land use transport policy purposes, this analysis suggests that improving eudaimonic wellbeing is likely to produce (a) long term benefits relative to hedonic wellbeing, which is typically fleeting (b) more widespread benefits to society (and not just to the self, as with hedonic wellbeing) and (c) more comprehensive benefits for wellbeing, as it captures a broader range of human experience and functioning than life satisfaction. Improving life satisfaction might have initial value but, in and of itself, is likely to have more temporary value if eudaimonic wellbeing is not concurrently promoted. This line of thinking suggests that, as eudaimonic wellbeing is more comprehensive and enduring than life satisfaction, it might be more highly valued, as this paper has demonstrated, but also more difficult to achieve, especially if the support systems are not sufficient.

When designing and evaluating wellbeing interventions, it is thus important to consider the desired outcomes and how hedonic and eudaimonic initiatives can contribute to these outcomes. Improving eudaimonic wellbeing, with its focus on purpose, personal growth and positive relationships, is likely to lead to pro-social spillover effects on communities and society, which suggests particular relevance for supporting building strong communities. This is currently a high priority of many governments, such as Vancouver, London and Singapore.

Building stronger/more complete (more cohesive) communities is substantially about improving the wellbeing of people in the associated communities. To align with this approach, advances are needed to measure and quantify eudaimonic wellbeing and not just life satisfaction. Case studies of initiatives to build strong communities, involving before, after and follow-up analysis of wellbeing impacts, will add considerably to our understanding of how the various components of subjective wellbeing change over time, following such interventions.

The social exclusion framing of analysis in the current paper has the benefit of enabling values for changes in both life satisfaction and eudaimonic wellbeing levels to be estimated in a consistent way, together with monetised values for several other policy-relevant variables, including bridging and bonding social capital, sense of community and trips. The resulting eudaimonic wellbeing and life satisfaction values (from Models 3 or 4) should be suitable for use in sectors beyond just land use and transport, since they are not seen as context-dependent unit values.

The research findings suggest that, when the high value of changes in eudaimonic wellbeing is recognized, the value of changes in life satisfaction may need to be reduced, perhaps by around 30-40 per cent. They also show, however, the opportunity for larger increases in total monetised wellbeing value if policy interventions can increase both life satisfaction and eudaimonic wellbeing, underlining the importance of taking a broader view of wellbeing than just life satisfaction.

Application of the monetised values for eudaimonic wellbeing developed herein would be assisted by their recognition in formal governmental CBA appraisal/evaluation guidelines (e.g., HM Treasury 2022; ITM 2020). Given that this is, we believe, the first international research evidence to estimate monetary values for eudaimonic wellbeing, inclusion of the resulting values in Appraisal Guidelines could realistically begin in the form of what UK Guidelines call *Indicative Monetised Impacts* (DfT 2016). This might involve sensitivity testing of the effect of including/not including eudaimonic

wellbeing benefits estimated herein on an initiative's benefit/cost ratio and identification of switching values, at which this benefit item changes an initiative's value for money rating.

The analysis has raised concerns about the usefulness of a single item measure of wellbeing, finding a substantial difference between a life satisfaction value inferred from a single item measure and one inferred from a seven-domain PWI measure. The (lower) single domain measure of life satisfaction has the great advantage of ease of application but needs further research to demonstrate validity. The (higher) seven-domain measure might be expected to provide a more robust measure of life satisfaction but will be more costly to implement.

These conclusions need to acknowledge some weaknesses in the research. In particular, and unlike research on life satisfaction, the lack of research by others on the monetised value of eudaimonic wellbeing means there are no comparator studies against which to evaluate or benchmark the current research findings, although benchmarking against UK life satisfaction values is encouraging. There is an urgent need for such studies, given the high value of eudaimonic wellbeing identified herein and the consistency of this finding about high value with expectations about eudaimonic wellbeing arising from the literature survey.

The lack of agreement about what constitutes eudaimonic wellbeing is a further limitation. This research has used Ryff's (1989) widely used measurement of eudaimonic wellbeing as the basis for its monetisation. This is likely to give richer insight into eudaimonic wellbeing than a single question measure but it also much more data intensive than the single question approach, which poses a challenge for application. Other conceptualisations may produce different findings, underlining the need for further research.

Finally, the data base on which this research has been based in now 18 years old. The value of this data base is its richness in terms of policy-relevant influences, which supports extensive monetisation research. The rise in virtual networks over recent years, however, may have changed some of the associations identified herein. Encouragingly, Urry (2002, p. 255) argues that "intermittent co-presence appears obligatory for many forms of social life", suggesting the values derived herein may survive the challenge from virtual networks. Further research is needed to explore such questions.

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