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Travel mood scale: Development and validation of a survey to measure mood during transportation

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ABSTRACT

Research on the relationship between transportation and mood has relied primarily on paper diaries that ask participants about their general satisfaction and mood during transport over a given period of time (e.g., the past week). This approach is vulnerable to recall bias. Some researchers have used surveys for participants to complete immediately after a trip in order to reduce recall bias, but this approach requires participants to carry a paper survey while travelling. Advances in phone technology enables researchers to measure mood immediately after a trip, thereby reducing recall bias and participant inconvenience. We build on prior research by developing a mood scale for use in transportation studies that utilize smartphone applications. This article introduces the development of the *Travel Mood Scale* (TMS), which was administered along with the *Satisfaction with Travel Scale* (STS) to 738 college students. When rating their mood, participants were asked to consider their most recent trip. The TMS was shown to have adequate internal reliability and correlated highly with the STS, demonstrating convergent validity. Ordinary least squares regression models showed that transportation mode, trip purpose, activities completed during the trip, and participant gender were significantly related to mood for both the TMS and STS, thereby supporting construct validity of the TMS. Specifically, mood was more positive when participants used active travel, went on nonwork/noneducational trips, and talked to other people during the trip. Compared with males in the sample, females reported feeling less safe when traveling. The concise nature of the TMS provides easy integration with smartphone apps, thereby providing a promising tool for assessing mood in transportation research.

1. Introduction

In the United States, a person travels on average 70 min per day (Bureau of Labor Statistics, 2018). Whereas traveling is usually considered a disutility (i.e., people prefer less travel time; Legrain, Eluru, & El-Geneidy, 2015), Mokhtarian, Salomon, and Redmond (2001) found that residents in different San Francisco neighborhoods have an ideal commute time that is at least greater than zero minutes, suggesting travel (e.g., transition from work to home) may benefit mood. This could explain why people take the car "for a spin" or enjoy their walk to work (Ory & Mokhtarian, 2005).

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A variety of factors are associated with a person's mood during travel, including transportation mode. Active travel, such as cycling, has been shown to influence more positive mood and health benefits compared to motorized travel, such as transit or a personal vehicle (De Nazelle et al., 2011; De Vos, Mokhtarian, Schwanen, Van Acker, & Witlox, 2016; St-Louis, Manaugh, van Lierop, & El-Geneidy, 2014; Morris & Guerra, 2015). The negative effects of motorized travel are more salient during peak traffic hours (Cox, Houdmont, & Griffiths, 2006; Koslowsky, Kluger, & Reich, 2013). However, public transit users can use travel time to prepare for work or engage in leisure activities, thus making the commute either more useful or enjoyable (Jain & Lyons, 2008).

A particularly relevant definition of mood was proposed by Lane and Terry (2000): "a set of feelings, ephemeral in nature, varying in intensity and duration, usually involving more than one emotion". A related concept—satisfaction—is often measured in transportation settings; although, this person-state is more difficult to define. Giese and Cote (2000) argued that definitions of satisfaction could be summarized as an emotional or cognitive response that pertains to a particular focus at a particular time, after one experience or repeated exposure to a particular situation. While mood and satisfaction are distinct concepts, their definitions suggest some clear overlap.

The Satisfaction with Travel Scale (STS; Ettema et al., 2011) was developed to measure satisfaction and subjective well-being (SWB) during travel. While the word pairs in the STS can be considered mood states, administration of the STS focuses on satisfaction. SWB includes two dimensions—affective well-being and cognitive well-being—which are both components of the STS. Specifically, the STS is a semantic differential scale that includes three subscales: (1) positive deactivation vs. negative activation on opposite ends (e.g., calm vs. stress), (2) positive activation vs. negative deactivation on opposite ends (e.g., alert vs. tired), and (3) cognitive evaluation of travel (e.g., travel worked well vs. travel did not work well). The affective portion of the STS is two-dimensional, based on the core-affect model (Russell, 2003). Activation level (deactivation to activation) and valence level (positive to negative) make up these two dimensions, which result in four combinations (e.g., positive deactivation). Ettema et al. (2011) found the STS to be reliable (i.e., Cronbach's α's > 0.70).

Friman, Fujii, Ettema, Gärling, and Olsson (2013) conducted confirmatory factor analysis (CFA) on the STS and discovered three first-order factors—the three subscales from Ettema et al. (2011). Friman et al. (2013) discovered a second-order factor that included all three subscales, which they termed "global satisfaction". Although the STS was developed to measure travel satisfaction, the affective word-pairs suggest the scale could be used to assess mood during travel.

1.1. Developing a mood scale for travel

Relatively few studies have designed and evaluated measurement tools specifically to assess mood during transport. For example, Raveau et al. (2016) included only happiness as their measure of mood. While the findings of Raveau et al. (2016) were informative, the use of single-item surveys have been associated with reliability issues (Christophersen & Konradt, 2011; Sarstedt & Wilczynski, 2009). However, single-item scales are useful in some circumstances (e.g., when a semantic differential scale is applied) and if the measure is concrete (i.e., understood unequivocally by everyone) or narrow (Alexandrov, 2010; Wanous & Reichers, 1996). Morris and Guerra (2015) studied mood as a function of transportation mode with the *American Time Use Survey*, which included only two emotion words: happiness and sadness, and three emotion-related words: tiredness, pain, and stress.

The *Positive and Negative Affect Schedule* (PANAS: Watson, Clark, & Tellegen, 1988) has ten negative and ten positive affect words, but is typically too lengthy for a field study designed to measure instantaneous mood states (e.g., immediately after a trip). The *Profile of Mood States* (POMS: McNair, Lorr, & Droppleman, 1971) is another mood scale that has been used in many settings, such as the exercise and clinical domains (Fritz & O'Connor, 2016; Kim & Smith, 2017). It includes six sub-scales (e.g., Depression-Dejection, Vigor-Activity, etc.) and a total of 65 items. A shortened version of the POMS, the *Short Form of the Profile of Mood States* includes 37 items (POMS-SF: Curran, Andrykowski, & Studts, 1995; Shacham, 1983). Although 37 items is a more reasonable number, it may still be too long for participants to complete immediately after a trip. The University of Wales Institute of Technology (UWIST) Mood Adjective Checklist is shorter with 29 items and three domains: energetic arousal, hedonic tone, and tense arousal (Matthews, Jones, & Chamberlain, 1990), but is also rather long.

The PANAS and most available mood scales incorporate a Likert scale (i.e., participants rate their degree of agreement or disagreement with a certain word or phrase). Likert scales readily measure participants' feelings or opinions, and provide quantitative values for statistical analysis, but they have a few disadvantages. For example, the negative pole of the Likert scale is typically on the left, with the positive pole on the right. When the poles are switched, higher negative scores are obtained among English-speaking respondents. Also, some items are negatively worded, requiring participants to reverse their thinking, which then requires a reverse score for the item. The positive and negative versions of the same item do not lead to identical responses among participants (Hartley, 2014; Nicholls, Orr, Okubo, & Loftus, 2006), suggesting issues with reverse scoring.

The semantic differential scale is an advantageous alternative to the Likert scale. In this case, two bipolar word-pairs are presented (e.g., happy vs. sad), and participants rate their feelings on a line scale between the word-pairs, with ratings closer to a word suggesting feelings closer to that word than the other. While semantic differentials reduce some of the disadvantages of Likert scales, such as acquiescence bias (Friborg, Martinussen, & Rosenvinge, 2006), this measurement approach also has potential limitations. Specifically, the bipolar word-pairs need to be true opposites of one another; otherwise, statistical and interpretation issues become a concern (Bentler, 1969; Heise, 1969). Also, semantic differential scales can lead to extreme responses at the end points (Eutsler & Lang, 2015).