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Complex active travel bout motivations: Gender, place, and social context associations[☆]

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Abstract

Active travel bouts are healthy, but bout-specific motives, social, and physical contexts have been poorly characterized. Adults (n= 421 in 2012, 436 in 2013) described their moderate activity bouts over the past week, aided by accelerometry/GPS data integration. Participants viewed maps indicating date, time, and starting and ending locations of their past week moderate-to-vigorous active travel bouts of 3 or more minutes. These prompts helped participants recall their social and physical contexts and motives for the bouts. Three bout motivations were modeled: leisure, transportation, and their “T-L” difference scores (transportation minus leisure scores). Blends of leisure and transportation motives characterized most bouts, even though most studies do not allow participants to endorse multiple motives for their active travel. Bouts were often neighborhood-based. Leisure motives were related to pleasant place perceptions, homes, and exercise places; workplaces were associated with stronger transportation and T-L bout motives. Women’s bout motives were more closely associated with place than men’s. Our novel method of individual bout assessment can illuminate the social-ecological contexts and experiences of everyday healthy bouts of activity.

Keywords

Physical activity; motivation; active transportation; bouts; complete street

1. Introduction

Physical activity recommendations state that adults should achieve 150 minutes of moderate-to-vigorous physical activity (MVPA) each week, accrued in bouts of 8–10 continuous minutes (Pate et al., 1995). When moderate activity is measured objectively by accelerometers, fewer than 5% of adults achieve those goals (Troiano et al., 2008). Newer research suggests that “every minute counts” for associations between MVPA and lower

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obesity and diabetes risk (Fan et al., 2013; Gay et al., 2016). Thus, researchers are eager to understand the motivational, social, and physical contexts of everyday MVPA bouts so that activity-friendly policies and designs can be developed. However, past research has often been limited to measuring categorical motivations, aggregate neighborhood walkability perceptions, and de-contextualized physical activity, without reference to social and physical contexts of activity bouts (Liao et al., 2014). Using a social ecological approach (Sallis et al., 2006), we employ a novel methodology that allows participants to assign motivations and describe social and physical contexts for individual MVPA bouts of active travel.

A review of past research showed that many active travel studies relate neighborhood walkability to active travel motivated by the desire for transportation (“getting someplace”) or leisure/recreation (Saelens and Handy, 2008). That review showed that transportation walks occur when neighborhoods have desired destinations nearby, such as one offering mixed land use (Saelens and Handy, 2008). Leisure/recreation walks occur in neighborhoods characterized as relatively pleasant (Saelens and Handy, 2008; Sugiyama et al., 2014) and crime-safe (Sugiyama et al., 2014), among other qualities. A more recent review of 46 studies confirmed that transportation walks relate to desired destinations and leisure walks to pleasant settings (Sugiyama et al., 2012). Findings can be complex, such as when a recent 12-country study found that leisure walks relate to pleasant settings in only 4 of 17 sites (Sugiyama et al., 2014) or when perceived walkability in Seattle was more strongly related to transportation than leisure walking (Shigematsu et al., 2009). It is not clear if the differences might be due to different places, people, or understandings of what constitutes leisure vs. transportation walks.

A major limitation to past research is that different geographies exist for areas assessed for walkability compared to active travel routes. Often, self-reports, GIS measures, and/or environmental audits are used to assess the entire neighborhood for walkability features such as pleasantness or crime-safety. These neighborhood measures are then related to self-reports of the amount of transportation or leisure walking done over the past week or months, regardless of where that activity occurs (Christiansen et al., 2014; Ding et al., 2012; Hirsch et al., 2013; McCormack et al., 2012; Saelens and Handy, 2008; Stronegger et al., 2010; Sundquist et al., 2011; Van Dyck et al., 2011). In reality, active travel trips only include part of one’s neighborhood and often go beyond neighborhood boundaries (Rundle et al., 2016). Some researchers have restricted their measurement of self-reported travel to neighborhood boundaries (McCormack et al., 2012), but most do not. This study overcomes the mismatch between the geographies assessed for walkability and active travel measures. Our participants provided perceived walkability for particular routes from the past week, aided by maps of their past week of MVPA active travel bouts provided by GPS/accelerometry data integration.

A second limitation in past research is that our knowledge of active travel motivations is based on surveys that require participants to summarize their past active travel trips into one of two categories: transportation-motivated or leisure/recreation-motivated. For example, common survey instruments such as the International Physical Activity Questionnaire—IPAQ-Long-- (Craig et al., 2003) and the National Health Interview Survey (NHIS, Paul et al., 2014) ask participants one set of questions about walking to get someplace/

transportation and a different set of questions for walking for fun or recreation/leisure. Although participants can classify their bouts into either category, it is not clear that people generally experience their active travel bouts as either transportation or leisure motivated. Within transportation research, both conceptual analyses (Alfonzo, 2005; Mokhtarian et al., 2015) and empirical research (Brown et al., 2003; Manaugh and El-Geneidy, 2013) demonstrate that people often hold multiple motives for a single travel-related behavior. Accordingly, we ask participants about both transportation and leisure/recreation motives for individual bouts, thereby avoiding the assumption that all active travel bouts are motivated by a single purpose.

We assume that questions about the two common active transportation motives are intended to represent “transportation but not leisure-motivated travel” or “leisure but not transportation-motivated travel.” Therefore, in addition to separate measures of transportation and leisure motivation, a third outcome is created to represent these distinctions. We subtract the leisure motive from the transportation motive score, resulting in a “T-L motive.” Positive T-L scores indicate that transportation motives are more important than leisure motives and negative scores indicate that leisure motives are more important. These transportation, leisure, and T-L outcome measures will be examined for distinct social and physical contexts.

Asking participants about specific past bouts allows us to characterize their individual social and physical contexts. Social contexts of family, work, and other relationships may figure into decisions about active travel (Guell et al., 2012) or provide enjoyable company for walking (Romero, 2015). The social scene when walking may be important, as when pedestrians contribute to the vibrancy of a place (Jacobs, 1961) or when trustworthy neighbors relate to more walking (Kaczynski and Glover, 2012). In contrast, one study has found that participants are alone for 37% of their MVPA episodes (Liao et al., 2014). Thus, the types and amounts of company adults have when engaged in active travel merit description.

We also investigate particular places of interest for physical activity, by examining participants’ home-based, work-based, exercise locale and complete street trips. A complete street project, involving construction of a new light rail, bike lanes, and a wider sidewalk, provided a community intervention between the two years of data collection. Businesses and services along the street did not change much over one year, so we did not anticipate differences over time in active travel motives along the street. Nonetheless, research rarely provides the opportunity to connect a particular neighborhood venue to motivations across two years, holding the site constant across all residents. In addition, we can evaluate other places that are more person-specific. We investigate home-based, workplace-based, and exercise locale trips. We would expect transportation motives to be associated with the complete street and workplaces and leisure motives to be associated with home and exercise locales.

Finally, we explore gender effects. An early systematic review of environmental correlates of physical activity showed that potential gender differences for walkability perceptions were often not tested. When tested, men’s walking but not women’s was sometimes related to

pleasant environments (Wendel-Vos et al., 2007), although the opposite was found in a more recent study (Pelclová et al., 2014). Perceived crime safety has been found to associate more strongly for women's walks (Foster and Giles-Corti, 2008; Suminski et al., 2005; Van Dyck et al., 2015). Thus gender by place interactions will be examined.

In sum, we ask:

- a. whether active travel is motivated by a need to get someplace, or recreation/leisure, or both;
- b. how social and physical contexts and gender characterize active travel;
- c. how physical contexts (the complete street intervention site, work- or home-based, or exercise locale bouts) and social accompaniment (with family, friends/acquaintances, coworkers, and/or others) relate to activity motivation?

2. Methods

2.1 Participants

Participants were drawn from the larger Moving Across Places Study (MAPS, $n = 536$) cohort that participated for two consecutive years. The subsample for the current study included participants who could recall details of their MVPA travel bouts during their past week of accelerometer wear, for each of two years ($n = 421$ and 426 in years 1 and 2, respectively, as explained later in sample description). Eligibility requirements for the larger study included residence within 2 km of the complete street project, anticipation of not moving during the follow-up period, absence of pregnancy, ability to walk a few blocks, Spanish or English language, and ability to fill out surveys and provide informed consent (details in Author, 2014).

2.2 Procedure

Participants wore accelerometers and GPS units for approximately one week. At the beginning of the week, a research assistant met with the participant, usually in his/her home, to explain how to use accelerometers and GPS units and to administer surveys. At week's end, the research assistant returned to download the accelerometer and GPS data from the past week's activities onto research laptops. These data were uploaded and integrated on a web site custom-designed by GeoStats (now Westat). The web site showed participants Google Maps of their starting and ending points for all past week MVPA bouts of 3 minutes. Reliance on accelerometer data underestimates bicycling bouts because accelerometers do not measure cycling movements well (Herman Hansen et al., 2014). The map showed the time, place, day, and route for each bout. Participants were asked to recall the social and physical contexts and motivations for the past week of bouts, up to 10 bouts per person, a cutoff developed to minimize participant burden.

2.3 Measures

2.3.1 Accelerometer and GPS active travel measures—Waist-worn accelerometer (Actigraph GT3x+ recording at 80 Hz and 10-second epochs) and GPS units (GlobalSat 100) have been found to be reliable instruments (Aadland and Ylvisåker, 2015; Abraham et

al., 2012). Both devices were initialized by the research assistant and participants recharged GPS units overnight. Accelerometers were positioned over the right front hip bone. To be included in the two-year cohort, participants needed to have ≥ 3 days of accelerometer wear for ≥ 10 hours/day in year 1. Valid wear and MVPA definitions were taken from National Health and Nutrition Examination Survey (NHANES). Non-wear hours had 0 accelerometer counts per minute (cpm), except allowing for up to two minutes with <100 cpm. Moderate activity was ≥ 2020 cpm, based on a weighted average of past studies that defined moderate cpm thresholds (Troiano et al., 2008).

The GPS devices were set to log at 3-second intervals and GeoStats (now Westat) merged the data into 10-second epochs. After the data had been collected, GeoStats employed a Trip Identification and Analysis System (TIAS) to post-process the point coordinates captured by the GPS loggers. One of the steps performed in this process was to identify and block points which did not represent actual travel. Examples of these include: adjacent points with unreasonable speeds, trajectory backtracking, and data wandering. The capture of GPS points that have these characteristics is typically caused by multipath errors (reflections of satellite signals arriving at the antenna), satellites going in and out of view of the antenna, and satellite signal blockages (Hofmann-Wellenhof et al., 1997).

Active travel was defined as non-motorized travel trips. Trip end flags were initially assigned to dwell or stationary times of ≥ 120 seconds; dwell times of 10–120 seconds flagged for further evaluation. Motorized travel was defined as travel averaging over 16m/s. Travel mode transitions from motorized to non-motorized were detected by the average and SD of speed within a moving window of 10 GPS points. Trip mode changes were initially defined when each window's mode status differs from the prior one and the speed SD ≥ 2.25m/s. Final definition of the exact point of mode change required checking point-by-point through the window to mark when the GPS points fell above or below the non-motorized speed threshold. In this way, each minute of GPS data collection was classified for whether it was active travel and if so, which mode, by GeoStats based mainly on speed and accelerometer indicators of physical activity. Additional details on distinctions among active travel modes, such as walking or biking, are provided elsewhere (Miller et al., 2015).

2.3.2 Recalled active travel bouts—As noted above in 2.2 (Procedure), participants were asked to recall details of up to 10 past week MVPA bouts of ≥ 3 minutes. Participant recalls were aided by a laptop display showing for each MVPA bout the starting and ending locations, the route taken, dates, and times. For the current article, bouts were selected from the entire pool of ≥ 3 minute MVPA bouts if they satisfied two conditions. First, they had to involve active travel based on GPS measures of speed, as described above. This excludes stationary bouts, such as those achieved in exercise class or on a treadmill. Second, the participant needed to recall the bout in order to answer questions about social and physical contexts and motivations, as described below. Note that only the MVPA portions of active travel trips were automatically marked on the computerized map. The map marking of the MVPA bout ended when three minutes of non-MVPA were recorded. The mapped route would include short 2-minute breaks, such as a stop for a red light before crossing a street. Thus, if a walk had a 3-minute MVPA walk, then a 2-minute stop, then a 5-minute MVPA walk, the map would show the entire 10-minute route taken. On average, participants

recalled 3.31 GPS/accelerometer-verified MVPA active travel bouts (SD=2.90) at Time 1 and 3.61 (SD= 2.99) at Time 2 (from a pool of 10.15 total bouts per person in 2012 and 12.09 in 2013). All further references to bouts analyzed in this article should be understood as bouts involving active travel, with 3 contiguous minutes MVPA, which the participant recalled.

2.3.3 Transportation and leisure motivation measures—To assess motivations for the bouts of activity, residents were asked, “How important were the following goals to this activity?” Participants rated, on a 1–5 scale (“not at all important” to “very important”) whether getting someplace, getting leisure or recreation, or getting exercise were important to their activities. The current study examines both leisure and transportation motives for each bout (exercise motives were less frequent and are not considered here) and the T-L difference score (transportation minus leisure motive scores). The T-L score can range from –4 to +4, with negative scores representing stronger leisure than transportation motives and positive scores representing stronger transportation than leisure motives.

2.3.4 Social context—Participants characterized the company present during each bout of activity, using as many of the following categories as needed: with family, with friends/acquaintances, with co-workers, with others (described as “strangers or customers, for example”), or alone (the omitted category in the analyses). In instances of multiple types of social company, such as family and friends, all variables were retained in the analyses.

2.3.5 Physical context—Physical context was coded from maps of the past week’s bouts that were shared with participants. Figure 1 shows how the map provided by GeoStats used GPS data to auto-fill location names and addresses when possible, indicating start and end points and pathways for each active travel trip. Participants provided place names such as “home” or “work” when appropriate, which research assistants typed directly to the web site. Beginning or ending points involving home, work, or exercise locales were represented by dummy variables. Exercise locales were researcher-coded to include all indoor and outdoor places that are designed for physical activity (e.g., gyms, exercise classes, soccer or other sports fields, bowling alleys, golf courses, trails), which research assistants looked up on the web if in doubt (all activity codes had strong interrater reliabilities, with Kappas = .896). Consistent with the idea that active travel is often distinct from exercise, walking along a road was not defined as an exercise locale. Bouts that involved the complete street intervention site were defined with ArcGIS10.2 when any portion of the participant’s bout was within 40 meters of the street centerline.

2.3.6 Place perceptions—Participants rated each bout for two separate place perceptions that are commonly asked in walkability surveys. These are: “Did the place where the activity occurred feel safe from crime? Pleasant?” Responses were on a 5-point scale (1= “not at all,” 5= “very”). Figure 1 illustrates how an individual responded to one short walk from a light rail stop to a store; the questions about social context, goals, and place perceptions were presented to participants on separate screens but the responses are summarized here. The duration of the bout, in this case three minutes, was also shown to the participant (the Figure 1 date is obscured for anonymity).

2.3.7 Sociodemographic and control variables—Gender was assessed and age and ArcGIS-calculated street network distance between home and the complete street were retained as control variables in final models. Earlier models controlled for employment and temperature, but these variables were statistically insignificant and dropped from final models.

2.4 Data analyses

Three outcome variables – leisure motives, transportation motives, and their T-L difference scores—for each bout were regressed on social context, place perceptions of pleasantness and crime safety, and physical place indicators of home, work, exercise and complete street locations. Place perceptions of pleasantness and crime safety were positively correlated ($r = 0.42$) and created problems of multicollinearity when combined in the same multivariate model. Thus we conducted separate models for each of the two place perceptions, with Bonferroni adjusted alpha levels for the perceptions of the place ($.05/2 = .025$), a solution suggested by similar research by Dunton et al. (2007).

Linear mixed models (SPSSv21 procedure Mixed) were used to account for dependence in the data when repeated measures are clustered within participants (Maas and Hox, 2005; Rissel et al., 2012). The models included person-specific averages, grand mean-centered, to assess the between-person effects. In addition, within-participant effects were examined by “group” mean-centering within-participant experiences, in which the group refers to the set of bouts for each individual (Kreft et al., 1998). For Level 1 dummy variables, group mean centering provides intercepts interpreted as the unadjusted (weighted) mean for each individual (Enders and Tofighi, 2007). Participant was treated as a random factor and the participation year was treated as a repeated measure.

3. Results

3.1 Sample description

During each year, 46 of the 536 MAPS participants could not be included because they did not have any 3-minute MVPA bouts. Demographic comparisons in 2012 showed that those without MVPA bouts, compared to those with bouts, are more likely to be female (proportions female: .76 vs. .48) and older (51 vs. 41 years), and less likely to be employed (.48 vs. .70) and to rent (.34 vs. .50, all ANOVA $p < .05$). They did not differ on marital status, white race, college education, household income, access to a car, or BMI.

Furthermore, 97 of 536 in 2012 and 87 of 536 in 2013 did not have active travel bouts, as detected by GPS. Among those with active travel bouts, 18 participants in 2012 and 13 in 2013 did not recall those bouts. This brings the sample to 421 participants in 2012 and 436 in 2013; collectively, the participants recalled 3,707 active travel bouts. Compared to the full sample, those without active travel bouts or recall of such bouts were more likely to be female (.63 vs. .48), older (45 vs. 41 years), unemployed (.58 employed vs. .70), and with higher BMIs (30.13 vs. 28.68). Among sociodemographic variables that did not differ across participation groups, the recall sample proportions in 2012 included .68 white, .45 married, .37 college graduates, and .86 with access to a car; household incomes averaged \$41,903.

3.2 Bout motives

The average transportation (“getting someplace”) motivation of 3.78 (1–5 scale, $SD = 1.59$) is stronger than the average leisure/recreational motivation of 3.06 ($SD=1.64$; paired $t(3706) = 18.63, p > .001$). Overall, the participant’s rated importance of getting someplace is negatively related to his/her rated importance of getting leisure/recreation ($r(3707) = -.05, p < .01$). The low absolute level of the correlation illustrates that, for our participants, experiencing a transportation-related motive for a bout does not preclude also experiencing a leisure-related motive, and vice-versa.

Recall that the T-L difference scores capture distinctions between transportation and leisure motivations. Consistent with the averages described above, only 21.8% of the bouts have leisure/recreation motives as more important than getting someplace. In 32% of the bouts there are identical values for transportation and leisure motives, yielding a 0 difference score. In 46.2% of the bouts, “getting someplace” is more important than leisure/recreation.

3.3 Social and environmental contexts

Overall, as shown on Table 1, most active travel bouts (62%) occur in the presence of “other” people (defined as “strangers or customers, for example”), thus likely to be people who are not well-known to the participant. For about a quarter of bouts, either family or friends or both are present as well, with fewer bouts in the presence of co-workers; 16% of bouts were alone.

Places designed for exercise, such as parks or recreation centers, account for only 13% of recalled active travel bouts while the complete street accounted for 22%. Home-based bouts, the most popular physical context, account for 44% of bouts. Participants generally perceived their MVPA bout places to be pleasant and crime safe, with both rated over 4 on a 5-point scale.

3.4 Motivations: personal, contextual and place pleasantness associations

Leisure motives, transportation motives, and their T-L difference scores (transportation minus leisure motives) provide the three outcomes in Table 2, starting with the three models that included the perceived pleasantness walkability measure. Each model includes Level 1 within-participant variables, which describe how a particular bout of activity compares to other bouts from that participant; Level 2 participant averages, which describe how each participant compared with others in the sample; and participant-level sociodemographic variables.

At Level 1 (bout level), social contexts, perceived physical contexts, and physical places have significant associations with motives. For social contexts, as one might expect, families and friends are likely to be along for leisure bouts but not transportation bouts, especially “purer” transportation bouts represented by T-L motives.

Co-workers are more likely present for T-L motivated bouts and less likely to be present for leisure bouts. “Others,” such as customers or strangers, are likely to be present for all types of active travel bouts. In terms of places, leisure motives are related to pleasant place

perceptions, homes, and exercise places; workplaces are associated with stronger transportation and T-L bout motives.

Level 2 (person level) results show that participants who scored higher than other participants on leisure motives are more likely than other participants to have high scores on family, friend, and other presence, pleasant place perceptions, as well as home and exercise places. Transportation motives are associated with participants who have more bouts with others present and fewer exercise place bouts. T-L motives are associated with participants whose bouts have an absence of friends and family, low place pleasantness, and fewer home and exercise place bouts and more workplace bouts.

Turning to interaction effects, both the gender by place pleasantness and gender by complete street interactions are significant in two of three analyses. The pattern demonstrates that females' active travel bout motivations are more responsive to their ratings of places perceived as pleasant and to complete street location than are males' ratings. For example, females have stronger leisure motives in places perceived as more pleasant; males' ratings of their motivations are less dependent on their perceptions of place pleasantness (females' estimated leisure motives means at -1 and $+1$ SD on place pleasantness are 2.64 and 3.78; males' are 2.78 and 3.25). Conversely, females have weaker T-L motives (see estimated means in Figure 2), indicating less dominance of the transportation motive, in places perceived as more pleasant; males' motivations again are less dependent on place pleasantness. Females have stronger T-L motives off of the complete street compared to on it; males' motives do not differ as much by location (see Figure 3). Similarly, females have stronger transportation motives off of the complete street compared to on it (estimated means 3.86 vs. 3.69); males' motivations do not differ as much (3.69 and 3.74).

Age and residential distance to the complete street are unrelated to bout motivations. All three final models show significantly improved fit over unconditional models (the -2 Log Likelihood improves from 13038 to 11938 for leisure motives, 13238 to 12693 for transportation, and 16136 to 15139 for T-L motives, all $\chi^2 p < .05$). The patterns across models are similar in showing that females differentiate their motives by place more than do males.

3.5 Motivations: personal, contextual, and perceived crime safety associations

Results are quite similar when the place perception of crime safety is substituted into the model for place pleasantness, so Table 3 is shown in the supplementary materials. The one notable difference is that crime safety itself, either at Level 1 or 2, is not related to motivations for the bout, although the interactions are similar to those described for pleasant perceptions. For leisure motives, gender differences are minimal for low crime safety places (Male = 3.00, Female = 3.04), but females feel greater leisure motives than males in high crime safety places (M = 2.95, F = 3.09). For T-L motives, females have stronger T-L motives for low crime safety places than for high crime safety places (.86 vs. .60). Males T-L motives are similar across low and high crime safety places (.69 vs. .73). Most other social, physical, and demographic variables have similar predictive profiles across place pleasantness and crime safety analyses. Again, all three final models showed better fit than

unconditional models (the -2 Log Likelihood improves from 13035 to 12139 for leisure, 13234 to 12626 for transportation, and 16132 to 15265 for T-L motives, all $\chi^2 p < .05$).

4. Discussion

Unlike most studies that classify active transportation as either leisure- or transportation-motivated, the current study found that participants ascribed both motives in varying degrees to their past week MVPA travel bouts. The method used, which involved individualized mapping of the past week bouts, allowed a precise match between the particular place of the bout occurrence and the participant's reported motives and social-physical contexts. We found that leisure and transportation motives often intermingled. Among the bouts, 46% had stronger transportation motives, 22% had stronger leisure motives, and 32% had identically strong motives for transportation and leisure. Given that behaviors that fulfill multiple motives may be more stable than those that fulfill one motive (Brown et al., 2003; Steg and Vlek, 2009), physical activity advocates and researchers may want to explore more fully the multiple motives that participants experience in active travel bouts.

We also utilized a difference score (T-L motives) to understand bouts that were clearly more transportation or more leisure motivated. Across models, transportation motives were less strongly associated with social and physical contexts than were leisure and T-L motives. In most cases the transportation motive had the same effect (i.e., sign of the coefficient in the model) as the T-L motive, but the latter was larger in absolute value and significance. Wanting to get someplace and simultaneously having a weak leisure/recreation motivation yields a more distinctive experience, which might be described as less pleasurable. That is, one is likely to be without the company of friends or family, with co-workers or "others," and going to/from a workplace, and where the place was perceived as less pleasant than other places. When past researchers have asked about transportation-motivated active travel, we suspect they wanted participants to describe activities that were high on transportation motives and low on leisure motives. The difference score approach may be one way to assure that the measure is more clearly transportation or leisure, without a blending of motives.

Few studies have examined social contextual features of MVPA active travel bouts. Dunton and colleagues used ecological momentary assessment, which queries participants for immediate recalls of their situation, to study activity contexts of high-schoolers (Dunton et al., 2007) and adults (Liao et al., 2014). This study and those two show adults are less likely to be with friends—25% of bouts in our study and 20% in Liao et al -- than high schoolers, who had between 35% and 41% of their bouts with friends (although Liao et al. may underestimate specific types of company given that 30% of their bouts combined multiple but unspecified types of company). High schoolers were with family for 13–21% of active travel bouts, the Liao et al (2014) adults had family-only present 13% of the time (again, likely an underestimate), and we found family present in 25% of bouts. Both adult samples were much more home-oriented in their bouts, with Liao et al. (2014) reporting 54% of activity incidents home-based, and the current study 44% of bouts home-based, compared to only 16–18% for the teen sample. Thus, the past week map-prompted recall used in the

current study differs from the ecological momentary assessment results, but both methods convey fairly similar pictures of adult social contexts in contrast to teen social contexts.

In terms of physical contexts, the current study illustrates that neighborhood streets deserve greater attention as a major source of healthy physical activity. Consider, for example, that 22% of recalled active travel bouts involved the complete street, but only 13% involved exercise-related places, such as parks. Although the complete street attracted more bouts in year 2 after its completion (281 year 1 vs. 549 year 2), there was no street by year interaction effect for the motivation outcomes, suggesting that the street was related to participant motivations similarly each year. Also, 44% of active travel bouts involved going to or from home, which would typically involve the neighborhood street. Although one study found that most light to MVPA occurred outside the neighborhood (Hillsdon et al., 2015), the current study underscores the importance of the neighborhood for MVPA active travel bouts for this sample.

Although motivational patterns did not change over time, there was evidence of gender interactions with place perceptions and complete street bout location. Women were likely to be in places perceived as less pleasant and crime safe when they were experiencing stronger transportation than leisure motives. Similarly, women experienced stronger leisure motives in pleasant places and crime safe places and lower leisure motives in less pleasant and crime safe places than men. Men showed similar but attenuated patterns. Past research has suggested that women may feel a need to be more attentive to their surroundings in public in order to stay safe and that women perceive the same scenes to be more fearful than men (Blöbaum and Hunecke, 2005; Boomsma and Steg, 2014), perceive aesthetics to be poorer than men in the same neighborhood (Trumpeter and Wilson, 2014), and are more attentive to neighborhood walkability conditions than men (Yan et al., 2010). These results would be consistent with the idea that women's perceptions of place pleasantness and crime safety are more allied with their motivations for active travel than are men's; this study's method allows us to show that this is true when all bout-specific perceptions, not just neighborhood perceptions, are analyzed.

Another discovery reported here is that transportation motives were stronger than leisure motives for this sample (i.e., 46% vs. 22% of bouts) than for others documented in past research. The 2005 National Health Interview Survey asked U.S. respondents whether, in the past week, they walked to "get someplace" or walked for "fun, relaxation, exercise, or to walk the dog." Among men, 30.3% walked for transportation and 38.9% walked for leisure. Among women, 26.4% walked for transportation and 43.9% walked for leisure (Kruger et al., 2008); similar results emerged from 2010 NHIS data (Paul et al., 2014). However, motivation variations across cities have also been found (Christiansen et al.; Van Dyck et al., 2013). For example, a recent 12-country study found more minutes of transportation than leisure walking using IPAQ for residents of Baltimore and Seattle (Kerr et al., 2016; Van Dyck et al., 2013), which suggests we do not yet know what favors the balance for these self-reported recalls of the two major types of walks. Transportation walking is also more likely in disadvantaged neighborhoods and the current neighborhood had incomes below the city median (Turrell et al., 2013). To explore this difference, we found that the self-reported IPAQ summary durations of all walks for transportation were longer by 11% than their

walks for leisure, suggesting that this sample is similar to those in recent IPAQ studies. Thus, when asking for transportation motives two ways in this study, participants favored transportation motives with both methods, but especially when queried about particular bouts. Additional studies comparing recalls of precise GPS/accelerometer-verified bouts with more frequently used summary recalls, such as IPAQ, are needed to provide more comprehensive understanding of how accounts of walking and the motives for walking differ.

For practitioners, if results are replicated elsewhere, the implications are worth noting. First, T-L motives were connected to bouts in ways that suggest improved places and practices are needed. Participants conducted these relatively high transportation/low recreation motivated bouts without the pleasure of company by family or friends and in places deemed to be less pleasant than other places the participant encountered. These chores might represent an area that could benefit from new innovations in active living. For example, workers are encouraged to take part in “walking meetings” or have treadmill or cycle desks (Commissaris et al., 2016) and families have started “walking school buses” for children to get to school (Kearns et al., 2003). Perhaps co-workers, families or friends could be encouraged to walk together for errands in order to benefit from social contacts with friendly faces during what might otherwise be a less pleasant time. Similarly, important destinations that involve transportation bouts, such as stores or transit stops, might benefit from more pleasant design features along the way. In terms of leisure bouts, co-workers were noticeably absent. Health programs might encourage co-workers to take more leisure walks together.

For researchers, this study suggests that the field can explore more in-depth and contextualized motivations for activities, with better matching of place and activity assessments. Methods are always constrained by budgets and participant burden. Yet surveys could be altered to allow participants to describe both transportation and leisure motives to their past bouts. As technology progresses, accelerometer-prompted experience sampling (Dunton et al., 2016) could allow immediate post-bout recalls. Bout-specific measures can be adapted to address a wide range of physical contexts, such as restorative environments or playgrounds, and activities, such as less intense or sedentary bouts. The method could also employ open-ended descriptions of motives, which might prevent the potential problem of alerting participants to the motives that interest the researcher, as was done in this study.

The present study suggests some features of healthy bouts of activity have not received sufficient research attention. For example, 62% of travel bouts were in the presence of “others,” explained in the present web-based survey as involving “strangers or customers, for example.” The presence of others was positively related to leisure, transportation, and T-L motives in the current study. We know the “others” are not the other survey options of family, friends, acquaintances, or co-workers, but we have no additional identity information for the “others.” We suspect that the “others” are often people sharing the street or pathway, although future research is needed to confirm this suspicion. Although past research has suggested that physical activity might be inspired when residents see others active in their neighborhood (Adlakha et al., 2015), it is not clear what effect “others,” including strangers, might have on one’s activity or activity motivations across a broad range of places. Urban planning research has suggested that the “familiar strangers encountered on the street add to

the vibrancy and positive experiences of urban life (Jacobs, 1961; Milgram, 1977). In contrast, disreputable strangers, constituting “social incivilities” (LaGrange et al., 1992), may degrade the experience of active travel. Future research could explore whether “others” seen during travel are perceived positively or negatively.

The study was limited to one week of accelerometer wear per year across two years and some participants had no active travel. The study also depended on participant memory for past week activities, but provided prompting from maps that showed route, time, and day to facilitate recall. Due to limited numbers of active travel bouts per person, potential interactions with a wide range of individual difference characteristics could not be fully explored, although some gender interactions were noted. Furthermore, these data do not support a causal claim that walkable design leads to walking. As noted by Chaix et al., individuals interested in walking may choose more walkable paths, which they call a mobility bias (Chaix et al., 2013). However, other research on this neighborhood actually demonstrates that some walkable features (e.g., residential density and offices) are associated with walking but some non-walkable features (graffiti, low traffic safety) are also associated with walking (Tribby et al., 2016). Thus, future research on chosen and non-chosen paths is encouraged to assess various influences from environment and selection.

In sum, by specifying the participant’s place and time of past bouts and allowing them the freedom to ascribe different strengths of leisure and transportation motives to past week bouts, the present study has provided a level of specificity that is unavailable in most studies. The study results suggest the utility of examining motives in combination and relating these motives to aspects of social and physical contexts. Results also underscored the importance of the neighborhood context in active travel and demonstrated that a complete street site can support active travel MVPA bouts.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Highlights

- Both home and a complete street neighborhood site hosted many bouts of activity
- Many bouts combined transportation & leisure motives, with the former stronger
- Transportation but not leisure motivated bouts were in the least pleasant places
- Women's activity motives were more responsive to places than men's
- Pleasant transportation place designs & policies are needed, especially for women

Please fill in **START** location name and address for activity on
Wednesday, Ju at 10:04 AM:

Name	TRAX stop
Address	JACKSON/EUCLID STATION, Salt Lake City, UT 84116, USA

Please fill in **END** location address.

Name	Family Dollar
Address	876 Emmerl Avenue, Salt Lake City, UT 84116, USA

Company: "Others"

Goals: Get someplace = 4

Goals: Leisure = 3

Place safe from crime = 4

Place is pleasant = 5

Figure 1.
Example bout including self-reported company, goals, and place perception (1–5 scales).

Figure 2.
Gender X pleasant place interaction for Transportation – Leisure motives.

Figure 3.
Gender X complete street interaction for Transportation – Leisure motives.

Table 1

Descriptive statistics

Variable	Minimum	Maximum	Mean	SD
Leisure motivation	1.00	5.00	3.06	1.64
Transportation motivation	1.00	5.00	3.78	1.59
T-L motivation	-4.00	4.00	0.72	2.34
Activity bouts (Level 1)				
Family present during activity	0.00	1.00	0.26	0.44
Friend present during activity	0.00	1.00	0.25	0.43
Co-workers present during activity	0.00	1.00	0.15	0.36
Other person present during activity	0.00	1.00	0.62	0.49
Place is pleasant	1.00	5.00	4.25	1.03
Place is crime safe	1.00	5.00	4.56	0.82
Complete street activity	0.00	1.00	0.22	0.42
Home-based activity	0.00	1.00	0.44	0.50
Work-based activity	0.00	1.00	0.19	0.39
Exercise-based activity	0.00	1.00	0.13	0.33
Participant averages (Level 2)				
Family present during activity	0.00	1.00	0.25	0.31
Friend present during activity	0.00	1.00	0.25	0.28
Co-workers present during activity	0.00	1.00	0.16	0.26
Other person present during activity	0.00	1.00	0.60	0.35
Place feels pleasant	1.00	5.00	4.24	0.78
Place feels crime safe	1.00	5.00	4.57	.62
Complete street activity	0.00	1.00	0.22	.24
Home-based activity	0.00	1.00	0.45	0.32
Work-based activity	0.00	1.00	0.20	0.29
Exercise-based activity	0.00	1.00	0.12	0.21
Gender and control variables				
Female	0	1	.46	.50
Age	18	84	40.41	14.26
Distance to complete street (100ms)	.25	21.12	9.23	5.28

Table 2
Activity motivation by social and environmental contexts and pleasant environmental perceptions

	Leisure motives			Transportation motives			T-L motives		
	Estimate	SE	p	Estimate	SE	p	Estimate	SE	p
Intercept	2.64	0.18	0.01	3.93	0.19	0.00	1.29	0.24	0.00
Level 1 (L1), within person									
Family present during activity	0.30	0.06	0.01	0.07	0.07	0.32	-0.24	0.10	0.01
Friend present during activity	0.37	0.06	0.01	-0.16	0.06	0.01	-0.53	0.09	0.01
Co-workers present during activity	-0.48	0.08	0.01	-0.06	0.09	0.50	0.41	0.13	0.01
Other person present during activity	0.15	0.06	0.01	0.44	0.06	0.00	0.28	0.09	0.01
Place feels pleasant	0.34	0.03	0.01	-0.10	0.04	0.01	-0.45	0.06	0.01
Complete street activity	0.04	0.07	0.54	0.07	0.07	0.37	0.02	0.10	0.82
Home-based activity	0.14	0.05	0.01	-0.16	0.06	0.00	-0.29	0.08	0.01
Work-based activity	-0.14	0.08	0.06	0.19	0.08	0.02	0.33	0.12	0.01
Exercise-based activity	0.88	0.08	0.01	-0.63	0.08	0.00	-1.51	0.12	0.01
Level 2, between persons									
Family present during activity	0.46	0.13	0.01	-0.29	0.15	0.05	-0.75	0.19	0.01
Friend present during activity	0.62	0.13	0.01	-0.24	0.15	0.10	-0.85	0.19	0.01
Co-workers present during activity	-0.35	0.19	0.06	-0.41	0.21	0.05	-0.15	0.27	0.58
Other person present during activity	0.32	0.11	0.01	0.54	0.12	0.00	0.27	0.16	0.10
Place feels pleasant	0.35	0.05	0.01	0.07	0.06	0.26	-0.29	0.08	0.01
Complete street activity	0.27	0.17	0.12	-0.16	0.20	0.41	-0.46	0.25	0.07
Home-based activity	0.45	0.14	0.01	-0.27	0.15	0.08	-0.71	0.20	0.01
Work-based activity	-0.21	0.18	0.24	0.25	0.20	0.22	0.54	0.26	0.04
Exercise-based activity	1.07	0.19	0.01	-0.53	0.21	0.01	-1.65	0.27	0.01
Gender and control variables									
Female	-0.01	0.10	0.94	0.06	0.10	0.55	0.08	0.13	0.56
Age	0.01	0.00	0.06	0.00	0.00	0.57	-0.01	0.00	0.05
Distance to complete street (100ms)	0.00	0.01	0.92	-0.02	0.01	0.11	-0.02	0.01	0.20
Year, first Interactions	0.03	0.06	0.57	0.02	0.08	0.83	-0.01	0.10	0.93
L1 pleasant place * Female	0.19	0.05	0.01	-0.10	0.06	0.08	-0.29	0.08	0.01

	Leisure motives			Transportation motives			T-L motives		
	Estimate	SE	p	Estimate	SE	p	Estimate	SE	p
L1 complete street activity * Female	0.03	0.10	0.76	-0.32	0.11	0.01	-0.34	0.16	0.03