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Who doesn't mind waiting? Examining the relationships between waiting attitudes and person- and travel-related attributes

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Abstract
Waiting, whether for *services*, for *someone*, or for *something*, is an inescapable part of life. This paper addresses a gap in the waiting time literature by examining previously sparsely studied relationships between individual- and travel-related characteristics and attitudes toward waiting using a revealed preference dataset of Northern California commuters (N = 2617). Correlational analyses, followed by a trivariate seemingly unrelated regression equations model, are developed for three waiting attitudinal constructs: *general* tolerance toward waiting, and attitudes toward *equipped* and *expected* waiting. Socioeconomic and demographic characteristics, time use perceptions and preferences, personality traits, multitasking attitudes (polychronicity), commute preferences and expectations, and general attitudes (e.g. pro-technology) are all seen to have significant effects on waiting attitudes. As this survey was executed on commuters, it also facilitates a unique simultaneous exploration of travel and wait time attributes, time uses that are often similarly viewed in day-to-day life. From this perspective, we see that longer commute times and distances are correlated with negative attitudes toward waiting, while commuters with pro-transit, pro-density, and pro-active transportation attitudes tend to have positive attitudes toward waiting. Additionally, we see that those with preferences for multitasking in general or at their jobs can tolerate waiting better. Overall, this study constitutes a distinctive contribution to the waiting time literature, capitalizing on a rich dataset to make important connections between related time uses and a multitude of other variables—key among them polychronicity, with its potential ability to reduce the negative perception and experience of waiting. Findings from this study may also benefit transportation and other service providers by facilitating an understanding of how various consumer groups/demographics view waiting, thus enabling providers to better cater to diverse needs/populations.

Keywords Waiting · Wait episodes · Seemingly unrelated regression · Travel behavior · Travel time · Multitasking · Polychronicity

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Introduction

"Time waits for no man", but man often has no choice but to spend time waiting. This lack of control over waiting episodes, whether being stuck in congestion, waiting at the dentist's office, or simply waiting for a stubborn web page to load, is one of many contributing factors that influences the dominant negative perceptions of waiting. But, are there some who don't mind these unavoidable windows of time, even perhaps see them as a welcome break in a busy day, and dare we say *enjoy* them? Are there others for whom prior knowledge of the wait event can alleviate negative consequences? Further still, can being equipped while waiting reduce the burden (or disutility) of the wait event by allowing a secondary activity (i.e. multitasking) to take place? This study addresses these questions, developing detailed profiles of a general attitude toward waiting, as well as attitudes toward equipped and expected waiting.

The vast literature on waiting and wait times touches only cursorily on the effects of individual characteristics on waiting attitudes and experiences, with such studies looking at the effects of individuals' time styles on subjective waiting experiences (Durrande-Moreau and Usunier 1999), and the remainder of the literature focusing primarily on the effects of service-related factors on wait time expectations, experiences, and evaluations. However, attitudes toward waiting may in their own right influence waiting expectations, the resulting experiences, and thereafter behavioral choices made regarding associated events (Durrande-Moreau and Usunier 1999; Maister 1985). As such, it is of interest from both theoretical and applied perspectives to better understand attitudes toward waiting, and pertinently, the *people* who possess these differing attitudes. To the best of our knowledge, this paper is the first to model attitudes toward waiting as a function of a broad array of personal characteristics, including various behaviors and other attitudes.

Building on a previous study of the same dataset (Mishra et al. 2015), we base our analysis on a survey of Northern California commuters in 2011–2012 (N = 2617). The questionnaire inquires about travel-related behavior and attitudes, with particular attention paid to travel time and wait time. These two types of time share many similarities (and in many cases, may overlap) as among the most maligned time uses in today's fast-paced world, thus making the context of the survey particularly unique (Chatterjee et al. 2017; Kahneman and Krueger 2006; Office for National Statistics 2014). Additionally, given the negative perception of these time uses, both are often seen as auspicious targets for being reduced, or at least rendered more useful. This latter improvement is often proposed to occur via multitasking, i.e. the overlaying or interleaving of activities on/within travel and waiting "time envelopes" (Circella et al. 2012). The data used for this analysis enabled the study of the complex interrelationships among *travel attributes*, *wait time attitudes*, and *multitasking*, a useful contribution to the literature in each of these domains.

The remainder of this paper is organized as follows. First, we provide an overview of the relevant literature on waiting, after which we detail the survey instrument and data used for the analysis, providing descriptive statistics and relevant background information on prior analyses executed. We then describe the two primary components of the analysis: (1) the correlational analyses between waiting attitudes and person- and travel-related attributes; and (2) the predictive models of the effects of a wide range of person- and travel-related characteristics, expectations, and preferences on waiting attitudes. We close with a discussion integrating findings across waiting attitudes, travel attributes, and multitasking preferences.

Literature review

Waiting has been studied most extensively in the service and operations domains, often motivated by end goals that affect the "bottom line" (i.e. profit), such as improving customers' wait experiences and perceptions, and optimizing queue management (Antonides et al. 2002; Baker and Cameron 1996; Bielen and Demoulin 2007; Durrande-Moreau1999; Maister 1985; Pruyn and Smidts 1998; Taylor 1994). In line with this, both empirical and field studies have shown that wait experiences affect customer satisfaction, mood, and even their propensity to spend money in the future (Bielen and Demoulin 2007; Nie 2000), further incentivizing the importance of understanding and managing wait times for service-related entities. The factors that have been found to influence customers' wait experiences include characteristics of the waiting environment (noise level, aesthetics, etc.) and interruptions during waiting, among others (Antonides et al. 2002; Baker and Cameron 1996; Kaparias et al. 2017; Nie 2000; van Hagen 2011). Supporting these findings are behavioral and psychological theories that have been drawn upon to help service providers develop approaches and strategies for improving customers' wait experiences; for example:

- *assimilation-contrast theory*, which has been used to explain why customer satisfaction is strongly affected by differences between perceived and expected wait times,
- *attribution theory*, which has shed light on how service providers can increase customer acceptance of delay by providing acceptable reasons for the cause of said delay, and
- *stress management theory* which suggests that stress-reduction mechanisms like advance notice can help improve customers' wait experiences (Nie 2000).

As noted, this paper focuses on *commuters'* attitudes toward waiting, and emphasizes waiting that is related to travel, so it is pertinent to examine the literature on waiting in the transport context. While the objective of minimizing waiting in transportation is sometimes (though not always) motivated by goals (such as accessibility, equity, and travel satisfaction) that differ from those of the aforementioned general service industries, it is critical to remember that transportation *is* a service [more easily seen as such in the context of transit and transportation networking companies (TNCs)—e.g. Uber, Lyft], and much of the conceptual and empirical work done in the service and operations domains is relevant. This is made clearer by the rash of recent papers that study waiting primarily in the transport service context, and which largely reinforce findings from the general service literature. These studies have mainly focused on (1) assessing how transit wait incidents affect overall service satisfaction and quality assessment (Allen et al. 2018, 2019; Hadiuzzaman et al. 2019; Echaniz et al. 2019), and (2) identifying the factors that affect transit customers' wait experiences, with the aim of managing those experiences to improve affective/psychological perceptions of wait time (Baker and Cameron 1996; Durrande-Moreau 1999; Friman 2010; Ji et al. 2017a, b; Kaparias et al. 2017; Watkins et al. 2011). For example, Watkins et al. (2011) found that mobile real time information reduces both perceived and expected wait times for transit riders; Friman (2010) found that waiting was perceived less negatively when it was in-process rather than pre-process; and Fan et al. (2016) found that those at transit stops with no amenities, as well as women waiting for more than 10 min in insecure surroundings, perceive wait times as significantly longer than they are. In addition to the transit literature, recent work has examined wait times in the context of TNCs, showing that shorter wait times for ridehailing services (compared to alternative modes, e.g.

taxi, transit), as well as the desire to reduce travel time, are factors influencing the decision to use these services (Alemi et al. 2019; Chen et al. 2018).

It is pertinent to note here that the analyses presented in this paper do not have access to context-related variables such as weather, wait conditions (e.g. indoor vs. outdoor), etc.; however, there is clearly a significant amount of literature that has otherwise examined these effects. Furthermore, given that the study at hand models general *attitudes* towards waiting (rather than specific wait experiences), there is a conceptual basis for not including context variables that would guide the respondent to consider particular wait experiences. Nevertheless, future extensions of this work could certainly apply the same methodology to measuring and analyzing context-specific attitudes.

As with general services, wait time during travel impacts the utility of available choices, which may ultimately be reflected in travel behavior. For example, for transit, it has been found that wait time (as well as walk time) has more than twice the disutility of in-vehicle travel time, and given higher proportions of wait and walk time for transit, this is believed to be a factor influencing low transit adoption rates in certain areas (particularly in the absence of further disincentives associated with driving) (Wardman 2004). Additionally, the literature has examined the ability of "equipped" waiting (i.e. equipped with tools for passing the time, such as a smartphone or a book; Durrande-Moreau and Usunier 1999; Gasparini 1995; Wang and Hsu 2018) or travel-based multitasking (Lyons et al. 2007; Lyons and Urry 2005; Mokhtarian et al. 2015; Watts and Urry 2008) to improve the utility of wait time and travel time respectively, with a recent finding that a small but non-trivial portion of the commuter rail and carpooling mode shares can be attributed to the opportunity to productively multitask (using a laptop/tablet in this particular study) on these modes (Malokin et al. 2019).

Thus, we see that factors influencing waiting attitudes, expectations, perceptions, and experiences have been studied extensively within service industries, and most pertinently to this study, from the transportation service perspective. However, the factors studied are typically specific to either the service or the wait experience (e.g. lighting and music; van Hagen 2011), and rarely delve into individual-level attributes that might contribute to these varied wait time expectations and perceptions. We note that some researchers *have* speculated that such differences may play a role in moderating waiting experience (Baker and Cameron 1996; Pruyn and Smidts 1998), while others have studied individual characteristics that are specific to experience, such as mood before waiting and distraction levels (Durrande-Moreau 1999; Durrande-Moreau and Usunier 1999).

A foundational study to the present analysis (Mishra et al. 2015) identified the three key waiting constructs (i.e. waiting in general, or under conditions where the waiting was either expected or equipped) being modeled in this paper, and also related them to a small number of (mostly demographic) variables using descriptive statistics. This precursor study found that mean factor scores statistically significantly differed (between two or among all three of the attitudinal constructs) by variables such as gender, income, children, public transit use, and equipped-ness (with productivity tools). The present study substantially extends the previous one by: (1) comprehensively examining correlational relationships between personal and travel-related attributes and waiting attitudes, and (2) going beyond descriptive analyses to model the waiting constructs as a function of numerous socioeconomic and demographic (SED), lifestyle, and attitudinal variables, and further, weighting the sample used in these analyses to reflect population commute mode shares in the study area. Accordingly, the results can be taken to reflect roughly a population-level portrayal of the influence of these factors on waiting attitudes. This study also facilitates an integrated examination of the relationships between general multitasking and travel-based

multitasking attitudes on waiting; thus a number of gaps in the literature are addressed. We note that while the *empirical* scope of this work is outside the usual focus of applications for the service industry, it may benefit general service providers who can further understand how various customer groups view waiting, and in some cases cater to their specific needs. The *methodological* scope of this pair of studies (i.e. the attitude measurement process, followed by descriptive analyses and linked models of the identified attitudes) is quite broad, and could readily be adapted to waiting in a variety of service and other contexts.

Overview of data and prior analysis

Data used for this analysis comes from the Multitasking Survey of Northern California Commuters (N = 2617, including commuting workers as well as college students commuting to school) conducted in 2011–2012; additional details regarding the survey design and data collection effort can be found in Neufeld and Mokhtarian (2012). The survey comprised nine sections covering a diverse array of attitudinal, preference, and behavior measures including: general lifestyle attitudes and personality traits, general multitasking/polychronicity attitudes and preferences, daily life and commute expectations and behaviors, waiting attitudes, mode perceptions, recent commute trip attitudes and behaviors, reactions to the provision of WiFi on transit vehicles, transportation mode choice and general commute behaviors, and SED characteristics. The main purpose of the survey was to support the development of revealed preference commute mode choice and other commute behavior models, with an emphasis on capturing the influence of general and travel-based multitasking attitudes and behaviors on those choices. However, the latter distinctive emphasis supports a number of related analyses, including the one reported here.

In the present study, we use three waiting constructs extracted from the 11 waiting attitudinal statements (rated on a five-point scale: strongly disagree, disagree, neutral, agree, and strongly agree) contained in the survey (Part D; see Fig. 1 for response distributions for each statement), and relate them descriptively and predictively to a variety of other variables in the dataset. The attitudinal statements themselves were not worded with specific references to travel, but that section was related to the general subject of the survey with the following introduction:

> Travel often involves some form of waiting. For instance, you may have to wait in traffic, or you may have to wait for transit to arrive. For each of the following statements, please check the response that best expresses your opinions about waiting, especially during travel.

Accordingly, we view the reported responses as reflecting attitudes toward waiting in general to some degree, but where such attitudes would be context-specific, they will likely reflect one's attitudes toward waiting while traveling.[1]

In the prior analysis (Mishra et al. 2015), a model was constructed to identify the latent variables underlying the 11 waiting attitudinal statements in the survey. Based on initial hypotheses when developing the waiting statements, as well as evidence from exploratory

[1] Of course, not everyone will have read or internalized the preface equally thoroughly, so some respondents may have had a different context in mind when reporting their attitudes.

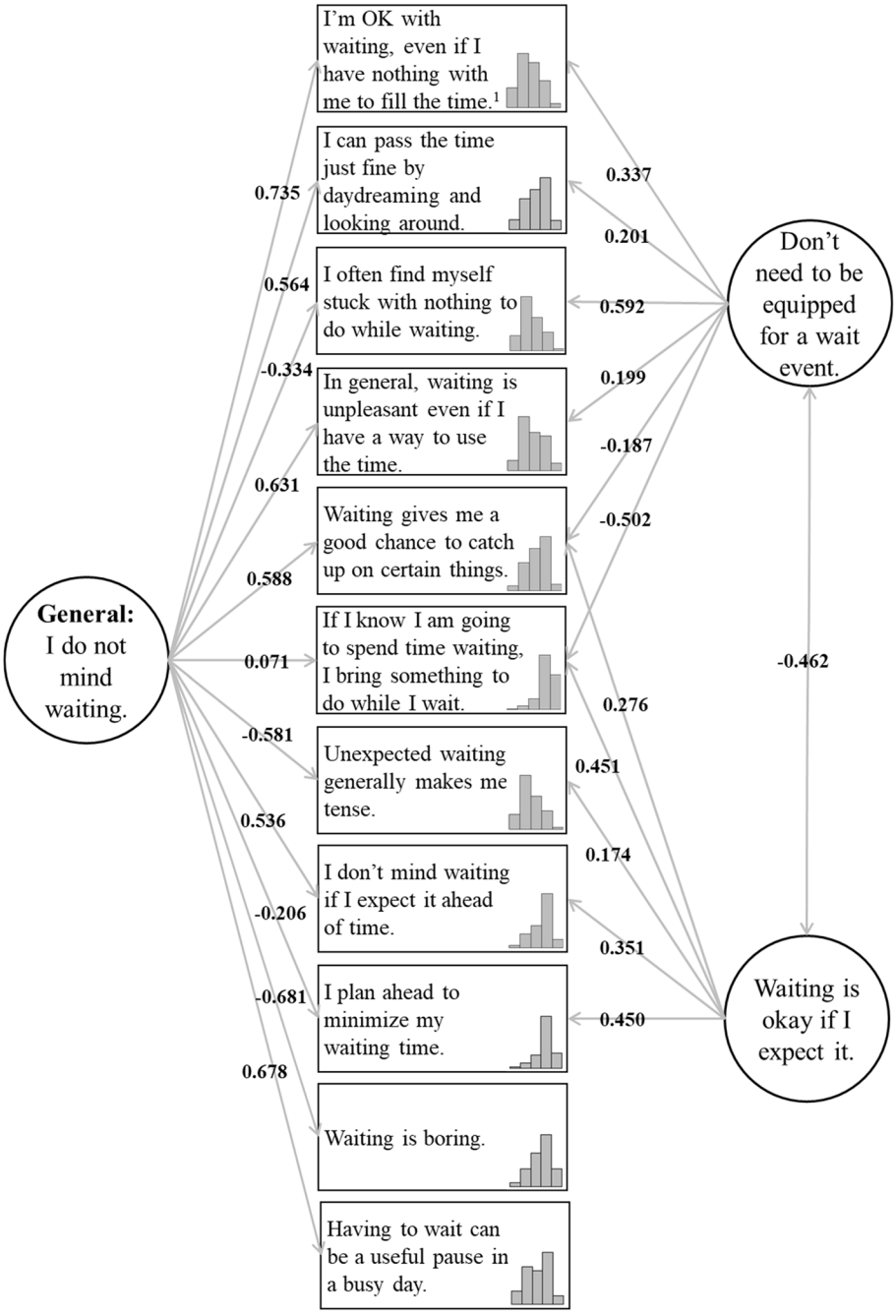

Fig. 1 Waiting constructs from the bi-factor model. [1]Note: Bar charts are scaled consistently and illustrate the unweighted sample distribution of the responses to the 11 waiting indicators, on a 5-point scale from 'strongly disagree' to 'strongly agree'. Single-headed arrows indicate an influence of the latent construct on the observed variable. Double-headed arrows indicate correlations between latent constructs. Numbers indicate the associated coefficients of the respective relationships. Measurement errors are suppressed for clarity. *Source*: Modified from Mishra et al. (2015)

factor analyses conducted on the empirical data, it was determined that the statements shared a common core, namely a general attitude about waiting, which could explain a significant amount of the variance among statements and, as detailed in Mishra et al. (2015), model specifications that could represent this structure were explored. Accordingly, the bi-factor model specification ultimately selected facilitated the partitioning of covariances of the manifest variables (i.e. the 11 waiting attitudinal statements) between a general factor and domain-specific factors. The domain-specific factors were labeled "I don't need to be equipped for a wait event" and "Waiting is okay if I expect it". This model structure is able to reflect the conceptualization that much of the observed covariation could *first* be explained by a general orientation toward waiting (which underlay all 11 of the manifest variables), and that the equipped-ness and expected-ness nuances could represent separable "adjustments" to a general waiting attitude (i.e. partially explaining what was *left after accounting* for one's basic attitude about waiting) rather than *outgrowths* of such an attitude (which is what an alternative specification, a second-order model, would imply; Mishra et al. 2015). The standard assumptions of bi-factor models were relaxed in two ways for this application (Fig. 1), namely: (1) the domain-specific (equipped and expected) factors were allowed to correlate with each other; and (2) two of the manifest variables were allowed to associate with both the equipped and expected constructs. Additional details regarding the estimations of this bi-factor model, as well as initial exploratory analyses on the resultant factor scores, can be found in Mishra et al. (2015). Factor loadings from the prior analysis are shown in Fig. 1, and for clarity, we again note that this current paper *further describes* and *explains* via *a seemingly unrelated regression model* the three waiting attitudinal constructs extracted and detailed in Mishra et al. (2015).

Finally, we note that the survey was deployed with the goal of obtaining sizable (rather than representative) shares across all commute modes, and as such drive-alone commuters were undersampled while users of other modes were oversampled. Thus, prior to performing the analyses conducted in this paper, the dataset was weighted to be representative of the regional commute mode shares (as obtained from the American Community Survey 2006–2010 county-level data for the study area). The equivalent analyses on the unweighted dataset have been provided in the "Appendix", with further details regarding these in appropriate sections of this paper. Descriptive statistics for the weighted and unweighted datasets are included in Table 1, and illustrate the effects of weighting based on the commute mode shares (with relatively little difference between the unweighted and weighted samples with respect to other variables). As shown in Table 1, approximately 62% of the weighted sample is female, and the average age of all respondents is 44 years. Additionally, roughly 37% of the weighted sample has an annual household income of more than $100,000, about half of the sample identifies their occupation as professional/technical, and slightly more than a third of the sample belongs to two-person households. Additional details regarding survey variables can be found in Malokin et al. (2019).

Results

This section is structured as follows. We first (the "Bivariate correlations" section) present a descriptive overview of significant bivariate correlations between the waiting constructs and variables representing the following attributes: mode choice; mode-related attributes; travel-based multitasking outcomes; SED characteristics; multitasking attitudes and preferences; commute preferences and expectations; time use patterns, preferences, and

Table 1 Selected characteristics of the sample (N = 2617)

Variable	Category	Frequency[a]			
		Unweighted		Weighted	
		N	%	N	%
Gender	Male	1018	38.9	955	36.4
	Female	1562	59.7	1627	62.2
Age[b]	18–24 years	133	5.1	138	5.3
	25–34 years	574	21.9	538	20.5
	35–44 years	547	20.9	593	22.6
	45–54 years	677	25.9	686	26.2
	55–64 years	594	22.7	571	21.8
	65+ years	73	2.8	74	2.8
Annual household income	Less than US $50,000	523	20.0	541	20.7
	US $50–100,000	990	37.8	988	37.7
	More than US $100,000	984	37.6	971	37.1
Education	High school diploma or less	80	3.1	93	3.6
	Some college or technical school	611	23.3	668	25.5
	College degree	835	31.9	850	32.5
	Some graduate school	280	10.7	246	9.4
	Graduate degree	810	31.0	758	28.9
Occupation	Full-time student	239	9.1	199	7.6
	Manager	427	16.3	457	17.5
	Professional/technical	1334	51.0	1296	49.5
	Clerical/administrative	393	15.0	399	15.2
	Other[c]	216	8.3	263	10.0
Household size	Single-person HH	425	16.2	453	17.3
	Two-person HH	994	38.0	923	35.3
	Three-person HH	513	19.6	526	20.1
	Four-person or larger HH	663	25.3	693	26.5
Mode shares	Bike	249	9.5	40	1.5
	Commuter rail	222	8.5	19	0.7
	Express/local bus/BART[d]/ferry	772	29.5	214	8.2
	Shared ride	402	15.4	326	12.5
	Drive alone	972	37.1	2018	77.1

[a]Frequencies do not add to 100% or the total N because of rounding errors, non-responses, or "other" categories

[b]Average age: 44 years (median: 45 years); lowest age: 19 years; highest age: 91 years

[c]Includes working homemakers, service and repair, sales or marketing, and production or construction

[d]Bay Area Rapid Transit, the metro rail system serving the San Francisco metro area

expectations; general attitudes; and personality traits. The travel-based multitasking outcomes were developed in a prior study, and represent the probability of commuters obtaining benefits and/or disadvantages of multitasking while traveling; specifically, hedonic (e.g. making the trip pleasant) and productive (e.g. allowing work to be completed) benefits, and cognitive (e.g. distraction) and affective (e.g. interfering with trip enjoyment)

disadvantages (Shaw et al. 2019). Because the relationships between waiting attitudes and many of these variables have rarely (if ever) been detailed in the literature, this comprehensive overview is a useful contribution toward understanding how a wide array of both general and transportation-related attitudes, preferences, and behaviors relate to waiting attitudinal constructs.

Next, we model the waiting constructs using a selection of the aforementioned variables that were hypothesized to have causal (one-directional) relationships with the waiting attitudes (the "Model estimation and analysis" section), but for which two-way causation is not believed to be present. Specifically, because attitudes toward waiting could be considered to be causal (or endogenous) with respect to mode choice, mode-related attributes, travel-based multitasking outcomes, and travel-related attitudinal constructs, these variables were excluded as predictors from the regression models developed in the "Model estimation and analysis" section. For example, while it is of interest to examine the effects of travel-based multitasking outcomes on waiting attitudes, we did not include this in the predictive models as there is a conceptual basis for believing that attitudes toward waiting could influence the benefits and disadvantages experienced as a result of travel-based multitasking (as well as the converse). For the same reason, we not only excluded the chosen mode as a *direct predictor* of waiting attitudes because the opposite direction of causality (waiting attitudes influence mode choice) is quite likely, we also did not develop models *segmented* by chosen commute mode. The latter specification, too, would represent an influence of the chosen mode on one's waiting attitudes (in essence the explanatory variables in the segmented models would be interactions of the original variables with commute mode), and therefore generate an endogeneity bias in the estimated coefficients. In other words, a coefficient of variable x that differs by mode would indicate the existence of *some* relationship between x, mode, and waiting attitude, but the model would confound the "mode-specific influence of x" on "waiting attitude" (the effect we would be trying to capture) with the influence of "waiting attitude in the presence of x" on "mode".

Thus, the "Bivariate correlations" section facilitates the observation of causality-agnostic patterns related to waiting attitudes, while the "Model estimation and analysis" section details more rigorous predictive results regarding causal effects on waiting attitudes. Table 7 (in the "Appendix") details the indicator statements/observations for the latent construct explanatory variables included in the analyses for both the "Bivariate correlations" and "Model estimation and analysis" sections (e.g. attitudinal statements which were factor-analyzed to reveal underlying attitudinal constructs).

Bivariate correlations

Tables 2 and 3 describe significant correlational relationships between the three waiting attitudinal constructs and core variable groups for the *weighted* data. The correlations between the waiting constructs and other variables for the *unweighted* dataset are included in Table 8 in the "Appendix". Depending on the nature of the second variable, either point-biserial (if dichotomous), Pearson (if continuous), or Spearman (if ordinal) correlation coefficients were calculated. From Table 2, we see that those with greater perceived amounts of time spent traveling and working, as well as those with time pressure and frustration, were more inclined to mind waiting; however, we reserve discussion on these since they are included in the predictive models. In this section, we discuss mode choice, mode-related attributes, travel-based multitasking outcomes, and travel-related general attitudes

Table 2 Bivariate correlations between waiting constructs and exogenous survey variables (N = 2617, weighted sample)

	I do not mind waiting	I don't need to be equipped for a wait event	Waiting is okay if I expect it
SED characteristics			
Gender (female)[a]	0.093**	−0.139**	0.143**
Age[b]	0.057**[1]	–	−0.081**
Household income[c]	−0.079**	−0.095**	–
Education level[c]	−0.018 [2]	−0.126**	0.099**
Multitasking attitudes and preferences[b]			
Preference for activity oriented multitasking	−0.032 [2]	−0.122**	0.161**
Preference for background noise	–	−0.039*[1]	–
Monotasking preference (day-scale)	−0.056**	0.054**	−0.042*[1]
Multitasking is normative	–	–	0.057**
Favorable personal reaction toward multitasking	0.086**	–	–
Preference for task oriented monotasking	–	0.132**	–
Feels expected to multitask on job	–	−0.098**	0.083**
Would like to multitask on job	0.052**[1]	−0.097**	0.089**
Commute preferences and expectations[b,c]			
Feels expected to work	−0.023 [2]	−0.127**	0.070**
Would like to work	−0.039*	−0.102**	0.047*
Feels expected to socialize/recreate	0.042*	−0.033 [2]	0.054**
Would like to socialize/recreate	–	−0.151**	0.132**
Feels expected to use same route	−0.075**	0.030 [2]	–
Would like to use same route	−0.064**	–	–
Time use patterns, preferences, and expectations[b]			
Feels expected to be constantly available	−0.030 [2]		
Would like to be constantly available	–	0.062**	–
Perceived time spent on traditional social and recreational activities	0.071**	–	–
Perceived time spent traveling	−0.097**	–	−0.039*[1]
Perceived time spent working	−0.135**	–	0.084**
Perceived time spent on non-work ICT	−0.050*[1]	–	–
General attitudes and preferences[b]			
Pro-technology	–	−0.039*[1]	0.091**
Real time pressure	−0.198**	–	0.162**
Preferred time pressure	−0.055**	−0.051**	–
Satisfied with life	0.118**	−0.124**	0.042*
Main benefit of job is money	–	0.050*	–
Would trade pay for day off of work	0.041*	−0.026 [2]	0.085**
Desire to own impressive vehicle	−0.074**	0.097**	–
Personality traits[b]			
Extraverted	0.087**	–	–
Organized	–	−0.064**	0.066**
Frustrated	−0.251**	0.058**	0.074**
Independent/alone	–	−0.044*	0.130**

Table 2 (continued)

	I do not mind waiting	I don't need to be equipped for a wait event	Waiting is okay if I expect it
Responsible	–	−0.135**	0.085**
Risktaker	–	–	−0.071**
Leader	−0.029 [2]	−0.040*	0.084**
Explorer	0.100**	−0.112**	0.102**

**, * Significant at 1%, 5% respectively

[1]Significant in the correlational analysis for weighted data, but not significant in the correlational analysis for unweighted data

[2]Significant in the correlational analysis for unweighted data, but not significant in the correlational analysis for weighted data. The insignificant coefficients in the latter case have been preserved in this table to allow for comparisons with the unweighted data in Table 8

[a]Point-biserial correlations (between continuous and binary variables)

[b]Pearson correlations (between continuous variables)

[c]Spearman correlations (between continuous and ordinal variables)

[c]These variables are based on statements asking participants what they feel they "have to, or are expected to do" and what they would "like to do" *on their commute*, and as such, should be read in the context of the commute

for the weighted dataset (Table 3) in greater detail, as these variables were not included in the predictive models.

Notably, commuters with trips that are longer in both time and distance tended to mind waiting more. However, commuters who reported that their commute allowed multitasking, who obtained travel-based multitasking benefits, or who perceived their chosen modes to be comfortable, convenient, conducive to multitasking, or generally beneficial, tended to mind waiting less than others, and tended to want to be equipped for a wait event and to say that waiting is okay if expected. Correspondingly, commuters who reported obtaining disadvantages due to travel-based multitasking tended to mind waiting more than others, and were more inclined than others to agree that "waiting is okay if I expect it," suggesting that individuals who are experiencing negative multitasking outcomes are less tolerant than others of *un*expected waiting.

We also see that commuters with pro-transit, pro-density, and pro-active transportation attitudes, as well as those who report having high satisfaction with life, were more inclined than others not to mind waiting and to agree that waiting is okay if expected, but less inclined to report that they don't need to be equipped for a wait event (suggesting that these attitudes co-occur with still wanting to be equipped for waiting). On the other hand, commuters who believe that travel time is a waste tend to feel that waiting is not okay under any circumstances (expected, equipped, and general). Finally, rail commuters were understandably more inclined to need to be equipped for a wait event, while drivers were less inclined.

For Table 2, Table 3 (correlations for weighted data), and (in the "Appendix") Table 8 (correlations for unweighted data), we included non-significant correlations *if and only if* that relationship was significant in the other table/dataset (example: if the correlation between choosing bike and "I do not mind waiting" is significant for the unweighted dataset but not the weighted dataset, we include the appropriate correlation in the table

Table 3 Bivariate correlations between waiting constructs and potentially endogenous survey variables (N = 2617, weighted sample)

	I do not mind waiting	I don't need to be equipped for a wait event	Waiting is okay if I expect it
Mode choice[a]			
Bike	0.025 [2]	–	0.026 [2]
Commuter rail	−0.013 [2]	−0.022 [2]	–
Express/local bus/BART/ferry (transit)	0.037 [2]	−0.050*	–
Shared ride	–	–	–
Drive alone	−0.030 [2]	0.062**	−0.028 [2]
Mode-related attributes			
Transit: waiting times (min)[b]	–	–	0.067**[1]
Transit: wait episodes (no.)[c]	−0.057*	–	–
Commuter rail: wait episodes (no.)[c]	–	–	−0.091**
Trip duration[b]	−0.060**	–	–
Trip distance[b]	−0.061**	–	–
Commute allows multitasking[c]	0.120**	−0.098**	0.082**
Perceived comfort of chosen mode[b]	0.095**	−0.104**	0.044*
Perceived convenience of chosen mode[b]	0.079**	−0.083**[1]	0.105**
Perceived multitaskability of chosen mode[b]	0.065**[1]	–	0.050*[1]
Perceived benefit of chosen mode[b]	0.104**	−0.024 [2]	−0.029*
Travel-based multitasking outcomes[a]			
Obtains productive benefits	–	−0.211**	0.131**
Obtains hedonic benefits	0.104**	−0.183**	0.138**
Obtains cognitive disadvantages	–	–	0.047*
Obtains affective disadvantages	−0.088**	–	0.078**
General attitudes and preferences[b]			
Pro-transit	0.030 [2]	−0.078**	0.053**
Travel is a waste	−0.357**	0.065**	−0.045*
Commute provides benefits	0.270**	−0.111**	0.021 [2]
Pro-active transportation	0.020 [2]	−0.095**	0.141**
Pro-density	0.109**	−0.073**	0.039 [2]

**, *Significant at 1%, 5% respectively

[1]Significant in the correlational analysis for weighted data, but not significant in the correlational analysis for unweighted data

[2]Significant in the correlational analysis for unweighted data, but not significant in the correlational analysis for weighted data. The insignificant coefficients in the latter case have been preserved in this table to allow for comparisons with the unweighted data in Table 8

[a]Point-biserial correlations (between continuous and binary variables)

[b]Pearson correlations (between continuous variables)

[c]Spearman correlations (between continuous and ordinal variables)

for the weighted data, but mark it with a footnote). We include the correlations for the unweighted data (Table 8), because as mentioned, the weighted data represents appropriate mode shares in the population, which substantially alters the sample sizes (N) for the mode choice variables specifically (for example, there are many fewer cyclists than motorists in

the population), and thus this change in sample sizes for the choosers of a given mode may conceivably be responsible for the shift in significance. Regardless of this and other differences in significant variables between the weighted and unweighted datasets, we draw attention to the fact that the magnitudes and signs are consistent for all of the relationships, and thus these relationships can be considered to be stable.

Finally, we note that statistical significance notwithstanding (which is, of course, partially a function of the generous sample size), the magnitudes of the correlations are quite modest—none greater than 0.357, and most less than 0.100. For most variables, this is not especially surprising, and signifies that at least with respect to the variables available to us, attitudes toward waiting are distributed largely independently across people. Clearly, there is a good deal left to learn about attitudes toward waiting.

Model estimation and analysis

We model the three waiting attitudinal constructs discussed in the "Overview of data and prior analysis" section using a trivariate seemingly unrelated regression equations (SURE) model. The SURE model consists of a set of regression equations having (potentially) differing explanatory variables which never include dependent variables from the other equations in the set (thereby rendering the equations "seemingly unrelated"), and which are therefore linked only through allowing their error terms to be correlated (Zellner 1962). This specification was selected on the basis that the three waiting constructs being modeled (i.e. "I don't mind waiting", "Don't need to be equipped for a wait event", and "Waiting is okay if I expect it") are conceptually related, and thus there is reason to expect some of the same unobserved variables to influence all three constructs. We use feasible generalized least squares to simultaneously and efficiently estimate the model.

The specification for the trivariate SURE model used in this analysis is as follows:

$$\begin{aligned} Y_{ij} &= \beta_{i0} + \beta_i' X_{ij} + \varepsilon_{ij}, \quad i = \text{factors 1, 2, 3} \\ &\quad \text{(general, equipped, expected waiting)}; \quad j = 1, 2, \ldots, N; \end{aligned} \tag{1}$$

where Y_{ij} is an estimate of the score for the jth observation on the ith waiting construct as obtained from the model shown in Fig. 1, X_{ij} is the vector of explanatory variables, β_{i0} and β_i' are coefficients to be estimated, and ε_{ij} is the error term. With the presence of the constant term β_{i0} we can assume $E(\varepsilon_{ij}) = 0$, and we further assume that the errors are independently-distributed across j (cases) (i.e. $E(\varepsilon_{ij}\varepsilon_{ij'})=0$ for $j \neq j'$). Let $\boldsymbol{\varepsilon_i}$ be the N-dimensional column vector of errors for factor i. Then correlations between the error vectors for equations i and k are given by (Heijmans and Neudecker 1998):

$$E(\boldsymbol{\varepsilon_i}\boldsymbol{\varepsilon_k}') = \omega_{ik} I_N, \quad i, k = 1, 2, 3, \tag{2}$$

where $\omega_{ik} = E[\varepsilon_{ij}\varepsilon_{kj}]$ and I_N is the $N \times N$ identity matrix. Tables 4 and 5 summarize the SURE models executed for this paper. Explanatory variables were entered into the model more or less in the following order: SED indicators; general multitasking/polychronicity attitudes; general time use and commute-related expectations and preferences, as well as self-reported assessments of current time use; and general attitudes and preferences. The model presented in Table 4 additionally includes personality traits as the final group among the explanatory variables studied, but is otherwise identical in initial specification to the model in Table 5. Insignificant variables were removed in successive stages and the model(s) re-estimated prior to moving to the next group. Selected variables were re-tested

Table 4 Trivariate SURE model results (final model with personality traits; N = 2430)

	I do not mind waiting coeff (t-statistic)	Don't need to be equipped for a wait event coeff (t-statistic)	Waiting is okay if I expect it coeff (t-statistic)
SED characteristics			
Gender (female)	–	−0.137*** (−4.41)	0.164*** (5.98)
Age	–	–	−0.00255** (−2.56)
Household income	−0.0425*** (−3.64)	−0.0311*** (−3.46)	–
Education	–	−0.0513*** (−4.23)	0.0593*** (5.65)
Multitasking attitudes and preferences			
Preference for activity oriented multitasking	–	−0.0595*** (−3.86)	0.0715*** (5.24)
Preference for background noise	–	−0.0430*** (−3.09)	–
Monotasking preference (day-scale)	−0.0432*** (−2.33)	–	–
Multitasking is normative	–	0.0412*** (2.96)	–
Favorable personal reaction toward multitasking	0.0436** (2.31)	–	–
Preference for task-oriented monotasking	–	0.0664*** (4.71)	–
Commute preferences and expectations[a]			
Feels expected to work	–	−0.0453*** (−2.99)	–
Feels expected to use same route	−0.0407** (−2.40)	–	−0.0218** (−1.97)
Would like to work	−0.0502*** (−2.65)	−0.0418*** (−2.76)	–
Would like to socialize/recreate		−0.115*** (−7.25)	0.0647*** (4.56)
Time use patterns, preferences, and expectations			
Perceived time spent traveling	−0.0508*** (−2.78)	–	–
Perceived time spent working	−0.0803*** (−4.33)	–	0.0311*** (2.60)
Would like to be constantly available	–	0.0672*** (4.95)	–
General attitudes and preferences			
Preference for time pressure	−0.050** (−2.61)	–	−0.0342*** (−2.77)
Satisfaction with life	0.050** (2.53)	−0.0614*** (−4.31)	–
Main benefit of job is money	–	0.0483*** (3.53)	–

Table 4 (continued)

	I do not mind waiting	Don't need to be equipped for a wait event	Waiting is okay if I expect it
	coeff (t-statistic)	coeff (t-statistic)	coeff (t-statistic)
Desire to own impressive vehicle	–	0.0465*** (3.43)	–
Pro-technology attitudes	–	–	0.0508*** (4.13)
Would like to multitask on the job	0.0352* (1.89)	–	0.0284** (2.43)
Rarely gets behind on things to do	−0.0580 (−3.10)	0.0572*** (3.97)	–
Personality traits			
Extraverted	0.0544*** (2.79)	0.0563*** (3.53)	−0.0479*** (−3.48)
Frustrated	−0.194*** (−10.23)	–	0.0426*** (3.55)
Explorer	0.0681*** (3.72)	−0.0490*** (−3.28)	0.0465*** (3.51)
Alone/independent	–	–	0.0709*** (6.04)
Like moving quickly	−0.0610*** (−3.13)	–	–
Frugal	−0.0499*** (−2.72)	0.0295** (2.15)	–
Risktaker	–	–	−0.0449*** (−3.78)
Organized	–	−0.0383** (−2.54)	
Responsible	–	−0.116*** (−7.35)	0.0488*** (3.67)
Model parameters			
Constant	0.135*** (2.72)	0.508*** (7.95)	−0.298*** (−4.46)
R^2 (Goodness of Fit)[b]	0.114	0.151	0.118

***, **, *Significant at 1%, 5%,10%, respectively

[a]These variables are based on statements asking participants what they feel they "have to, or are expected to do" and what they would "like to do" *on their commute*, and as such, should be read in the context of the commute

[b]These R-squared values are from simple regressions on the single-equation models, and are included to provide a general sense of the model fit

Table 5 Trivariate SURE model results (without personality traits; N = 2430)

	I do not mind waiting	Don't need to be equipped for a wait event	Waiting is okay if I expect it
	coeff (t-statistic)	coeff (t-statistic)	coeff (t-statistic)
SED characteristics			
Gender (female)	0.107*** (2.74)	−0.189*** (−6.11)	0.194*** (7.03)
Age	0.00380*** (2.42)	–	−0.00257*** (−2.59)
Household income	−0.0485*** (−3.93)	−0.0379*** (−4.18)	–
Education	–	−0.0457*** (−3.75)	0.0643*** (6.12)
Multitasking attitudes and preferences			
Preference for activity-oriented multitasking	–	−0.0595*** (−3.83)	0.0753*** (5.44)
Preference for background noise	–	−0.0476*** (−3.41)	–
Monotasking preference (day-scale)	−0.0406*** (−2.12)	–	–
Multitasking is normative	–	0.0491*** (3.50)	–
Favorable personal reaction toward multitasking	0.0379* (1.94)	–	–
Preference for task-oriented monotasking	–	0.0521*** (3.35)	0.0377*** (2.70)
Commute preferences and expectations[a]			
Feels expected to work	–	−0.0464*** (−3.02)	–
Feels expected to socialize/recreate	0.0529** (2.23)	–	–
Feels expected to use same route	−0.0535*** (−3.04)	–	−0.0255** (−2.28)
Would like to work	−0.0609*** (−3.13)	−0.0364** (−2.37)	–
Would like to socialize/recreate	–	−0.102*** (−6.47)	0.0553*** (3.90)
Time use patterns, preferences, and expectations			
Perceived time spent on traditional social and recreational activities	0.0377** (2.00)	–	–
Perceived time spent traveling	−0.0608*** (−3.21)	–	–
Perceived time spent working	−0.0834*** (−4.24)	–	0.0393*** (3.26)
Perceived time spent on non-work ICT	−0.0369* (−1.86)	–	–
Would like to be constantly available	–	0.0413*** (3.10)	–

Table 5 (continued)

	I do not mind waiting	Don't need to be equipped for a wait event	Waiting is okay if I expect it
	coeff (t-statistic)	coeff (t-statistic)	coeff (t-statistic)
General attitudes and preferences			
Preference for time pressure	−0.0525*** (−2.67)	–	−0.0286** (−2.28)
Satisfaction with life	0.0971*** (4.95)	−0.0782*** (−5.58)	–
Main benefit of job is money	–	0.0447*** (3.23)	–
Desire to own impressive vehicle	−0.035* (−1.84)	0.0504*** (3.74)	–
Pro-technology attitudes	–	–	0.0468*** (3.87)
Would like to multitask on the job	0.0345* (1.84)	–	0.0349*** (2.89)
Rarely gets behind on things to do	−0.0556*** (−2.90)	0.0406*** (3.04)	–
Model parameters			
Constant	−0.0565 (−0.67)	0.535*** (8.28)	−0.331*** (−4.99)
R^2 (Goodness of Fit)[b]	0.0711	0.118	0.0836

***, **, *Significant at 1%, 5%,10%, respectively

[a]These variables are based on statements asking participants what they feel they "have to, or are expected to do" and what they would "like to do" *on their commute*, and as such, should be read in the context of the commute

[b]These R-squared values are from simple regressions for the individual equations, and can be considered to be representative of the fit in the SURE model

Table 6 Estimated correlations of error terms for Tables 3 and 4

	I do not mind waiting	Don't need to be equipped for a wait event	Waiting is okay if I expect it
I do not mind waiting	1.000		
Don't need to be equipped for a wait event	−0.015 (−0.015)	1.000	
Waiting is okay if I expect it	0.117 (0.104)	−0.436 (−0.443)	1.000

Table 4 correlations shown in parentheses

and some variables were excluded based on interpretation prior to finalizing the model. Table 6 provides the correlations between the error terms for the three waiting constructs for both model specifications.

During experimentation with the model specifications, we arrived at two versions, which provide different perspectives (Tables 4, 5). The first specification (Table 4) includes personality traits, and has better fit statistics than the second model specification (Table 5); however, several SED characteristics and attitudes became insignificant after entering the personality traits. The second model specification retains the focus on traditional SED characteristics, and (although the fit is slightly lower) since the literature and practice are more populated with SED variables (e.g. age, income, etc.), we believe that the model in Table 5 allows for discussion and linkages that may not be possible/visible with the final model in Table 4, thus yielding a contribution in its own right. Comparison of the two models also suggests that behavioral and attitudinal differences that may be traditionally linked to SED and other such variables in the literature, may instead be more appropriately attributable to more fundamental variables such as personality traits.

Finally, as with the correlational analysis ("Bivariate correlations" section), in the "Appendix" (Tables 9, 10) we detail the final model (with personality traits, i.e. comparable to Table 4) and the error term correlations for the *unweighted* dataset. Comparisons between the results for the weighted versus unweighted data again indicates a fairly stable (though not identical) solution, with comparable fit statistics.

Model results

Here we highlight selected results from the final model (Table 4), and discuss differences between this model and the one in Table 5.

For the final model, we see that all SED characteristics examined in this model—gender, age, income, and education level—are significant for one or more of the constructs, with women (more than men) tending to want to be equipped for waiting and to say that waiting is okay if expected. Older participants have reduced tendencies to need to expect waiting for it to be okay, i.e. they appear to be more tolerant even of unexpected waiting. On the other hand, high-income and -education commuters in our sample tend to want to be equipped for wait events, with the high-income participants tending to mind waiting in general. For the model in Table 5 that does not include personality traits, we note that gender and age also yielded significant effects for the general waiting construct, with women and older age groups having reduced tendencies to mind waiting in general. We found it

useful to include the second model (Table 5) for precisely such reasons; that is, when personality traits were entered into the model, other variables such as SED characteristics and some attitudes became insignificant.

With respect to the attitudinal constructs tested, we see that a preference for having time pressure increases the tendency to mind waiting as well as the tendency to feel that waiting isn't okay even if it is expected. On the other hand, those who say that they are satisfied with life have a greater tendency not to mind waiting but also a greater tendency to want to be equipped for a wait event. Commuters who state that they rarely get behind on things to do have a greater tendency to mind waiting and to want to be equipped while waiting, suggesting an orientation toward efficient time use. Both those who see the main benefit of their job to be money and those with desires to own an impressive vehicle have a lower need to be equipped for wait events, possibly due to lower desires to utilize that time with work-related tasks.

Notably, those who have preferences for multitasking (whether on the job or not) tend to mind waiting less, while those with monotasking preferences tend to mind it more, suggesting that multitasking may alleviate some of the negative effects of waiting. However, those who would like to work on the commute tend to mind waiting more, which supports the expectation that wait episodes are disruptive to using travel time to work. It could also suggest that there are personal or mode-related barriers stopping such commuters from working during potential wait episodes[2] (Watts and Urry 2008). Understandably, we also see that both those who perceive spending more time working and those who perceive spending more time traveling tend to mind waiting more, with those who perceive spending more time on recreational activities tending to mind it less. Interestingly, the model also indicates that those who feel expected to use the same route have increased tendencies to mind waiting in general and even if it is expected.

Nine personality traits were significant for one or more constructs, and interestingly the inclusion of these traits eliminated two variables entirely from the (Table 5) model (specifically: feels expected to socialize/recreate, perceived amount of time spent on non-work ICT), and altered the significance for others (gender, age, expected to use same route, desire to own impressive vehicle, etc.). We see that commuters who are identified as being more extraverted or having explorer type personalities tend to mind waiting less, although those who are extraverted tend to say that they don't need to be equipped for waiting and waiting isn't okay if expected, while those who are identified as explorers have opposite tendencies for the latter two constructs. On the other hand, those who are identified as frustrated, liking to move quickly, and being frugal tend to mind waiting more. Interestingly, prior work has found that those with quantitative, economic time styles tend to have increased perceived time pressure and impatience while waiting (Durrande-Moreau and Usunier 1999), which may be reasonably extended to further contextualize the frugal personality trait finding in this study. Those who are identified as being organized and responsible have a greater tendency to want to be equipped for waiting. Thus, as can be seen the personality traits are highly interpretable (conceptually understandable) in this final model, and also improve the overall fit.

[2] As Watts and Urry (2008, p. 870) aptly put it, "Unpacking takes time and space; therefore a journey where there is not enough time or space to unpack creates a sense of being squashed, even if the person has a seat and the vehicle is clean and punctual. Passengers are forced either to remain packed whilst travelling and consequently can make little use of their time. Or, … passengers adapt to cramped and short journeys by only partially unpacking with music players, mobile phones, and novels ready-to-hand…".

Finally, we note that the model has reasonable R-squared fit values (~0.12) for prediction of attitudinal statements, with low correlations of error terms between the general construct ("I do not mind waiting") and the equipped and expected constructs. We note that the R-squared values are those from simple regressions on the constituent models, and can be considered to be representative of the fit for the three-equation system. The correlation between error terms for the general and expected constructs was small but positive (0.117), while the correlation between error terms for the general and equipped constructs was almost 0 (−0.015). We note that in the bi-factor model for developing the constructs, the correlation between the expected and equipped constructs themselves was −0.462 (this is a relaxation of a traditional assumption of bi-factor models), which is on par with the estimated error term correlation of −0.436 between the equations for the respective constructs. This is likely a manifestation of the relatively low (even if typical or better-than-typical) percents of variance explained (R-squareds) for the constructs themselves—two equations whose observed variables explain a great deal of the variation in their dependent variables would have lower residuals of *un*explained variance, and could be expected to have less variation due to unobserved variables *that are common to both equations*.

Discussion and conclusions

This analysis utilized data from a revealed preference survey of Northern California commuters to model a general attitude toward waiting, as well as attitudes related to equipped and expected waiting. The wait time literature is vast; however, to our knowledge this is the first analysis that has: (1) modeled the effects of a broad range of personal characteristics on waiting attitudes; and (2) executed analyses linking wait time attitudes, travel attributes, and multitasking attitudes and preferences.

The results (Tables 2, 3, 4, 5) show that a broad array of characteristics has significant predictive effects on waiting attitudes, including SED variables, personality traits, general attitudes and preferences, and time use patterns. We also see that commute preferences and expectations are significant predictors, with other travel-related attitudes and behaviors (not in the predictive model) also having significant correlations with the waiting constructs. Thus, a picture begins to emerge of the type(s) of individuals who inhabit these waiting attitudinal constructs, facilitating a better understanding of *why* these attitudes may exist, and *what* various groups of individuals do to alleviate or improve attitudes toward waiting.

Specifically, we see that respondents with lower tendencies to mind waiting are commuters who: tend to have lower incomes, have preferences for multitasking in general *and* at their jobs, tend to spend a lot of time on leisure activities, and have extraverted and/or explorer-type personalities. Those who have a lower need to be equipped for wait events tend to have lower incomes, lower education levels, and are more likely to be male. As expected, those who have preferences for multitasking, those who expect to work on the commute, and those who want to work on the commute, all have a greater tendency to want to be equipped for a wait event, as do those with organized and responsible personality types. Those with increased tendencies to believe that "waiting is okay if expected" are female, younger individuals, and those with higher levels of education. We also again see that those who have preferences for multitasking in *general*, or on their job, have increased tendencies to find expected waiting to be acceptable. To close out the discussion on personal characteristics, differences between Tables 4 and 5 suggest that personality traits can replace some sociodemographic characteristics and expectations/perceptions in models,

suggesting that more nuanced measures of heterogeneity (e.g. personality, as opposed to attributes like gender) may lead to improved understanding of observed behaviors and overall better model predictions.

Regarding the transportation side of this study, we see that longer commute times and distances are associated with reduced tolerance for waiting, which may be due to the survey focus on waiting during travel, or may simply suggest that respondents with longer commute times and distances have had negative experiences with waiting which have informed their attitudes. We also find that attitudes associated with travel have significant correlations with the waiting constructs, with those who find traveling to be a waste understandably tending to have unfavorable opinions towards waiting, even if equipped or expected. In addition, we see patterns with respect to mode choice: commuter rail passengers have greater tendencies than others to need to be equipped, while those who drive alone have lesser tendencies to need to be equipped (as the latter conceivably could not use productivity tools due to the constraints of their commute). As ridehailing services begin to obtain larger market shares, and even farther into the future, as increasing automation furthers the possibility of autonomous public transportation and shared vehicles, understanding the role of wait times and the locations of these wait episodes in the overall transport process will be of increasing importance to transportation system modeling and forecasting efforts (Csiszár and Zarkeshev 2017). We note that researchers have already started to examine differences in wait times for ridehailing services across different sociodemographic groups and in varying geographic areas, findings that may have implications for barriers to access to those services at the moment, as well as for spatial development in the future (Hughes and MacKenzie 2016).

With respect to multitasking preferences and behaviors, we see that commuters who: multitask on their commute and obtain hedonic benefits, report that their commute allows multitasking, and view their commute mode as being conducive to multitasking have greater tolerance for waiting in general, and as expected, have stronger inclinations toward wanting to be equipped for waiting and wanting wait events to be expected. Supporting these findings, we also see that those who report having disadvantages due to travel-based multitasking have less tolerance for waiting. Moving to the predictive results for the general multitasking attitudes (defined in Table 7 of the "Appendix"), we see that those with a favorable reaction towards multitasking have increased tolerance for waiting, while those with preferences for monotasking correspondingly have a reduced tolerance for waiting, presumably seeing it as dead time (unable to be filled with a secondary activity). Again, in line with the aforementioned findings, we see that those with preferences for activity-oriented multitasking have greater tendencies to want to be equipped and to expect their wait events. Finally, the survey also captured preferences for multitasking while on the job, and we found that this is a significant predictor of tolerance toward waiting and preference for expected waiting. We note as well that there is a growing body of literature on travel-based multitasking (multitasking during travel) which reports that multitasking can improve subjective trip perception and utility across modes in most though not all contexts (Banerjee and Kanafani 2008; Ettema et al. 2012; Mokhtarian et al. 2015; Rasouli and Timmermans 2014; Rhee et al. 2013; Russell 2012; Shaw et al. 2019; Susilo et al. 2012), findings that are echoed theoretically and empirically in the wait time literature under the parlance of equipped or distracted waiting (Maister 1985; Pruyn and Smidts 1998).

Thus, it is clear that, as waiting becomes increasingly important in transportation systems of the future, understanding individuals' profiles of various waiting attitudinal constructs may play a critical role in transportation scenario simulation and forecasting. Beyond transportation, however, this work provides useful contributions to the general wait

time literature, making connections across a wide range of individual characteristics and three fundamental waiting attitudes. We note that the context of the waiting attitudes studied in this paper are colored distinctly by the transport context of the survey, and acknowledge this as both a limitation and an added benefit. As one of the first papers to study waiting attitudes at this level of detail, we hope that these findings will encourage future work and investigations into both general and travel-related wait episodes. Achieving a better understanding of this inevitable time use will facilitate improving services, as well as planning, across sectors.

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Author contributions FAS: literature review, analysis and interpretation of results, manuscript preparation; AM: data collection and cleaning, manuscript review; PLM: survey instrument design, data collection, feedback on analysis, manuscript review; GC: survey instrument design, data collection, manuscript review.

Appendix

See Tables 7, 8, 9 and 10.

Table 7 Survey constructs with associated statements and loadings

Constructs	Statements[a]	Loadings[b]
Multitasking attitudes and preferences		
Preference for activity-oriented multitasking[c]	I typically do two or more activities at the same time	0.614
	I am comfortable doing more than one activity at the same time	0.545
	I like to juggle two or more activities at the same time	0.496
	Doing two or more activities at the same time is the most efficient way to use my time	0.403
Preference for background audio[c]	I generally like to have something (music/radio/TV) playing in the background	0.948
	Background music/radio/TV is too distracting for me	−0.835
Monotasking preference (day-scale)[c]	I would rather complete parts of several projects every day than complete an entire project	−0.916
	I would rather complete an entire project every day than complete parts of several projects	0.613
Multitasking is normative[c]	I believe people do their best work when they have many tasks to complete	0.800
	I believe people should try to do many things at once	0.504
	I believe it is best for people to be given several tasks and assignments to perform	0.433
Favorable personal reaction toward multitasking[d]	When doing multiple activities at a time, I feel: "dissatisfied" to "satisfied" (five point scale)	0.589
	When doing multiple activities at a time, I feel: "out of control" to "in control" (five point scale)	0.566
	When doing multiple activities at a time, I feel: "underappreciated" to "important" (five point scale)	0.534
	When doing multiple activities at a time, I feel: "the results are worse" to "the results are better" (five point scale)	0.527
	When doing multiple activities at a time, I feel: "not true to myself" to "true to myself" (five point scale)	0.511
	When doing multiple activities at a time, I feel: "less productive" to "more productive" (five point scale)	0.486
	When doing multiple activities at a time, I feel: "overwhelmed" to "energized" (five point scale)	0.446
Preference for task-oriented monotasking[c]	I believe it is best to complete one task before beginning another	0.519
	I prefer to do one thing at a time	0.501
	When I work by myself, I usually work on one project at a time	0.498
	I seldom like to work on more than a single task or assignment at the same time	0.413

Table 7 (continued)

Constructs	Statements[a]	Loadings[b]
Commute preferences and expectations[e]		
Feels expected or would like to work	Work during your commute	0.513
	Do "nothing" during your commute	−0.339
Feels expected or would like to socialize/recreate	Do recreational activities during your commute	0.641
	Socialize with other people while commuting	0.382
	Constantly be available to friends	0.299
Time use patterns, preferences and expectations		
Feels expected or would like to be constantly available[e]	Constantly be available to friends	0.678
	Constantly be available to family	0.669
	Constantly be available to co-workers/clients	0.568
Perceived time spent on traditional social and recreational activities[f]	Doing hobbies	0.427
	Getting exercise	0.379
	With family	0.369
	With friends	0.585
	Volunteering/doing service	0.320
Perceived time spent traveling[f]	Traveling (long-distance)	0.462
	Traveling (to/from work)	0.336
	Traveling (other local)	0.596
Perceived time spent working[f]	Amount of time you spend working	0.784
	Amount of time you spend relaxing	−0.452
	Amount of time you spend on the computer/phone/internet for work	0.415
General attitudes and preferences		
Feels expected or would like to multitask on the job[e]	On the job: work on several tasks in the time span of 1 h	0.492
	On the job: work on several tasks in the time span of 1 day	1.022
	On the job: work on several tasks in the time span of 1 week	0.714

Table 7 (continued)

Constructs	Statements[a]	Loadings[b]
Pro-transit[c]	I prefer to take transit rather than drive whenever possible	0.739
	I'd rather drive than travel by any other means	−0.588
	I like the idea of driving as a means of travel for me	−0.536
	I like the idea of transit as a means of travel for me	0.510
Pro-technology[c]	I like to be among the first to own new electronic products	0.755
	I like to track the development of technology	0.747
	I often introduce new trends to my friends	0.577
	The internet makes life more interesting	0.343
	Technology brings at least as many problems as solutions	−0.305
Pro-active modes[c]	I like the idea of walking (or biking) as a means of transportation	0.895
	I prefer to walk or bike rather than drive whenever possible	0.767
	I like the idea of living in a neighborhood where I can walk to the grocery store	0.420
Travel is wasted time[c]	I generally enjoy the act of traveling itself	−0.774
	The act of traveling is boring	0.710
	Time spent traveling is generally wasted time	0.592
	The only good thing about traveling is arriving at your destination	0.567
	I sometimes travel more than I have to, because I want to	−0.389
	To me, a car is mostly just a way to get from place to place	0.308
Commute benefits[c]	My commute is generally pleasant	0.773
	My commute is stressful	−0.769
	My commute serves as a welcome transition between home and work	0.372
Real time pressure[c]	I feel like I need to make the most of every single minute	0.433
	I'm often in a hurry to be somewhere else	0.674
	I'm too busy to do many things I'd like to do	0.476

Table 7 (continued)

Constructs	Statements[a]	Loadings[b]
Preferred time pressure[c]	I feel more productive when I am under pressure to complete work by a deadline	−0.709
	I do my best work when I have more than enough time to complete it	0.532
Satisfaction[c]	I am generally satisfied with my job	0.550
	I am generally satisfied with my life	0.806
Pro-density[c]	I like the idea of living somewhere with large yards and lots of space between homes	−0.635
	I prefer to live close to transit, even if it means I'll have a smaller home and more people living nearby	0.625
	Mixing different types of businesses (e.g., shops, restaurants, offices) with the homes in my neighborhood causes (or would cause) too much traffic or noise	−0.549
Personality traits[g]		
Extraverted	Fun-oriented	0.694
	Spontaneous	0.601
	Variety-seeking	0.537
	Adventurous	0.520
	Like to meet new people	0.439
	Risk-taking	0.308
Organized	Organized	−0.811
	Neat	−0.721
	Tend to procrastinate	0.467
	Efficient	−0.446
	Like a certain amount of chaos	0.353
	Often late	0.303
Frustrated	Tend to procrastinate	0.330
	Impatient	0.495
	Pessimistic	0.480
	Restless	0.475
	Perfectionistic	0.371
	Aggressive	0.345

Table 7 (continued)

Constructs	Statements[a]	Loadings[b]
Loner	Like being alone	0.526
	Like being independent	0.525
Responsible	Family-oriented	0.607
	Responsible	0.567
	Like to stick to a routine	0.322
Risk-taker	Risk-taking	−0.526
	Aggressive	−0.523
Leader	Efficient	−0.318
	Ambitious	−0.698
	Work-oriented	−0.513
	Like being in charge	−0.373
Explorer	Concerned about the environment	−0.751
	Curious	−0.494
	Like being outdoors	−0.396
Mode perceptions[h]		
Perceived convenience of chosen mode	Ability to run errands on the way to/from work	0.687
	Privacy	0.487
	Availability when needed/wanted	0.789
	Ability to carry things with me	0.343
	Door-to-door travel time	0.595
	Reliability	0.648
	Comfort	0.333
Perceived benefit of chosen mode	Effect on the environment	0.801
	Cost	0.591
	Avoiding congestion	0.625
	Amount of physical activity involved	0.578

Table 7 (continued)

Constructs	Statements[a]	Loadings[b]
Perceived comfort of chosen mode	Safety	−0.592
	Traveling in poor weather conditions	−0.559
	Comfort	−0.412
	Reliability	−0.333
Perceived multitaskability of chosen mode	Ability to run errands on the way to/from work	0.304
	Privacy	0.478
	Ability to carry things with me	0.493
	Ability to do things I need/want while traveling	0.490

Except where otherwise indicated, the numbers in this table are pattern matrix loadings from a series of factor analyses performed on respective blocks of variables from the survey, with oblique rotation of factors. Details of the factor analyses are documented in a series of internal working memos, available from the authors

[a]A statement can load on more than one construct. Constructs that do not appear in this table, but that appear in the results, are "standalone" variables, i.e., they are not latent constructs, but rather direct measurements from the survey responses

[b]Represents the degree of association between the statement and the construct. Only loadings greater than 0.3 in magnitude are reported

[c]Items measured on a 5-point Likert-type scale ranging from "Strongly disagree" to "Strongly agree"

[d]Items were in response to a statement, "When doing multiple activities at a time, I feel:", followed by a 5-point scale that measured a variety of feelings/self-assessments (detailed above) towards multitasking

[e]Items measured on a 3-point ordinal scale ranging from "Generally no" to "Generally yes"

[f]Items measured on a 5-point ordinal scale ranging from "Way too little" to "Way too much"

[g]Items measured on a 5-point ordinal scale for "how well each of the following words or phrases describes you", ranging from "Hardly at all" to "Almost completely"

[h]Items measured on a 5-point ordinal scale ranging from "Very bad" to "Very good". Identical blocks of items were presented to respondents for four different modes: drive alone, shared ride, local transit (including light rail and metro rail), and either commuter (intercity) train (for all paper survey respondents, and online respondents with commutes of 10 miles or more) or bicycle/walk (for online respondents with commutes less than 10 miles). To reduce respondent burden, the perceptions for the "shared ride" mode did not distinguish being the driver for the shared ride from being a passenger—the result being that the extent to which each of those possible roles influenced the reported shared ride perceptions is unknown. This raised the issue, for the models of Tables 4 and 5, of which set of perceptions to attribute to the "chosen mode", when the primary commute mode was shared-ride driver. Given that (1) many shared-ride drivers drive alone for some portion of the commute (before picking up the first passenger and after dropping off the last one); (2) the drive-alone perceptions came first in the survey (and thus shared-ride drivers may well have responded to those items from the perspective of a shared-ride driver as much as or more than from that of a solo driver); (3) perceptions of many of the items shown in the table could be expected to be similar for solo and shared-ride drivers; and (4) the drive-alone perceptions are the only ones that unambiguously pertain to the driving role, we took the drive-alone responses to best represent the chosen-mode perceptions for shared-ride drivers

Table 8 Correlational relationships between waiting constructs and key survey variables (unweighted) (comparable to Table 2 and Table 3 in paper)

	I do not mind waiting	Don't need to be equipped for a wait event	Waiting is okay if I expect it
Mode choice[a]			
Bike	*0.052***[1]	–	*0.056***[1]
Commuter rail	*−0.057***[1]	*−0.053***[1]	–
Express/local bus/BART/ferry	*0.057***[1]	*−0.051***	–
Shared ride	–	–	–
Drive alone	*−0.042**[1]	*0.092***	*−0.040**[1]
Mode-related attributes[b]			
Transit: waiting times (min)[b]	–	–	*0.012* [2]
Transit: wait episodes (no.)[c]	*−0.068***[1]	–	–
Rail: wait episodes (no.)[c]	–	–	*−0.068**
Trip duration[b]	*−0.106***	–	–
Trip distance[b]	*−0.105***	–	–
Commute allows multitasking[c]	*0.101***	*−0.159***	*0.080***
Perceived comfort of chosen mode	*0.064***	*−0.114***	*0.056***
Perceived convenience of chosen mode	*0.120***	*0.019* [2]	*0.039***
Perceived multitaskability of chosen mode	*0.034* [2]	–	*0.004* [2]
Perceived benefit of chosen mode	*0.126***	*−0.081***[1]	*0.052***
Travel-based multitasking outcomes[a]			
Obtains productive benefits	–	*−0.244***	*0.147***
Obtains hedonic benefits	*0.085***	*−0.208***	*0.129***
Obtains cognitive disadvantages	–	–	*0.048**
Obtains affective disadvantages	*−0.107***	–	*0.065***
SED characteristics			
Gender (female)[a]	0.070**	−0.096**	0.115**
Age[b]	0.036 [2]	–	−0.074**
Household income[c]	−0.099**	−0.103***	–
Education level[c]	−0.056**[1]	−0.135**	0.100**
Multitasking attitudes and preferences[b]			
Preference for activity oriented multitasking	−0.040*[1]	−0.102**	0.139**
Preference for background noise	–	−0.024 [2]	–
Monotasking preference (day-scale)	−0.039*	0.047*	−0.026 [2]
Multitasking is normative	–	–	0.048*
Favorable personal reaction toward multitasking	0.058**	–	–
Preference for task oriented monotasking	–	0.123**	–
Feels expected to multitask on job	–	−0.117**	0.095**
Would like to multitask on job	0.023 [2]	−0.102**	0.094**
Commute preferences and expectations[b,d]			
Feels expected to work	−0.051**[1]	−0.177**	0.097**
Would like to work	−0.047*	−0.139**	0.056**
Feels expected to socialize/recreate	–	−0.044*[1]	0.059**
Would like to socialize/recreate	–	−0.171**	0.159**
Feels expected to use same route	−0.084**	0.048*[1]	–
Would like to use same route	−0.072**	–	–

Table 8 (continued)

	I do not mind waiting	Don't need to be equipped for a wait event	Waiting is okay if I expect it
Self-reported assessment of current time use[b]			
Perceived time spent on traditional social and recreational activities	0.065**	–	–
Perceived time spent traveling	−0.137**	–	0.035 [2]
Perceived time spent working	−0.132**	–	0.071**
Perceived time spent on non-work ICT	−0.035 [2]	–	–
Feels expected to be constantly available	−0.040*[1]	–	–
Would like to be constantly available	–	0.054**	–
General attitudes and preferences[b]			
Pro-transit	*0.075*[**1]	*−0.121***	*0.052***
Travel is a waste	*−0.352***	*0.054***	*−0.051**
Pro-technology	–	–	0.075**
Commute provides benefits	*0.258***	*−0.116***	*0.043**[1]
Real time pressure	−0.218**	−0.064**	0.167**
Preferred time pressure	−0.067**	−0.063**	–
Pro-active transportation	*0.070*[**1]	*−0.098***	*0.135***
Satisfied with life	0.114**	−0.127**	0.063**
Pro-density	*0.073***	*−0.090***	*0.056*[**1]
Main benefit of job is money	–	0.045*	–
Would trade pay for day off of work	0.043*	−0.038*	0.097**
Desire to own impressive vehicle	−0.089**	0.112**	–
Personality traits[b]			
Extraverted	0.098**	–	–
Organized	–	−0.033 [2]	0.054**
Frustrated	−0.243**	0.053**	0.069**
Independent/Alone	–	−0.022 [2]	0.112**
Responsible	–	−0.080**	0.067**
Risktaker	–	–	−0.063**
Leader	−0.058**[1]	−0.058**	0.097**
Explorer	0.098**	−0.1115**	0.098**

Italicized correlations are associated with variables that were not included in the predictive models developed in the "Model estimation and analysis" section, due to endogeneity concerns as discussed within the text

**, * Significant at 1%, 5% respectively

[1]Significant in the correlational analysis for unweighted data, but not significant in the correlational analysis for weighted data

[2]Significant in the correlational analysis for weighted data, but not significant in the correlational analysis for unweighted data. However, the insignificant coefficients in this latter case have been preserved in this table to allow for comparisons with the weighted data in Table 2

[a]Point-biserial correlations (between continuous and binary variables)

[b]Pearson correlations (between continuous variables)

[c]Spearman correlations (between continuous and ordinal variables)

[d]These variables are based on statements asking participants what they feel they "have to, or are expected to do" and what they would "like to do" *on their commute*, and as such, should be read in the context of the commute

Table 9 Trivariate SURE model results with personality traits (N = 2444, unweighted sample) (comparable to Table 4 in paper)

	I do not mind waiting	Don't need to be equipped for a wait event	Waiting is okay if I expect it
	coeff (t-statistic)	coeff (t-statistic)	coeff (t-statistic)
SED characteristics			
Gender (female)	0.0821** (2.26)	−0.115*** (−3.75)	0.122*** (4.49)
Household income	−0.0436*** (−3.82)	−0.0334*** (−3.77)	–
Education	–	−0.0516*** (−4.17)	0.0534*** (5.09)
Multitasking attitudes and preferences			
Preference for activity oriented multitasking	–	−0.0553*** (−3.56)	0.0620*** (4.61)
Monotasking preference (day-scale)	−0.0360*** (−2.05)	–	–
Multitasking is normative	–	0.0504*** (3.68)	–
Favorable personal reaction toward multitasking	–	–	–
Preference for task oriented monotasking	–	0.0707*** (5.13)	–
Commute preferences and expectations[a]			
Feels expected to work	–	−0.0625*** (−4.09)	–
Feels expected to socialize/recreate	0.0443** (2.10)	–	–
Feels expected to use same route	−0.0323* (−1.94)	–	–
Would like to work	−0.0434*** (−2.43)	−0.124*** (−7.59)	–
Would like to socialize/recreate	–	−0.0497*** (−3.27)	0.0909*** (6.35)
Time use patterns, preferences, and expectations			
Perceived time spent traveling	−0.0820*** (−4.70)	–	–
Would like to be constantly available	–	0.0520*** (3.83)	–
General attitudes and preferences			
Real time pressure	−0.166*** (−8.92)	–	0.0502*** (4.20)
Preference for time pressure	−0.0512*** (−2.84)	–	–
Satisfaction with life	0.0591*** (3.16)	−0.0564*** (−4.05)	–
Would trade pay for day off of work	0.0373** (2.12)		0.0370*** (3.13)
Desire to own impressive vehicle	–	0.0541*** (3.90)	–

Table 9 (continued)

	I do not mind waiting	Don't need to be equipped for a wait event	Waiting is okay if I expect it
	coeff (t-statistic)	coeff (t-statistic)	coeff (t-statistic)
Pro-technology attitudes	–	–	0.0410*** (3.33)
Preference for multitasking on job	–	–	0.0216* (1.91)
Rarely gets behind on things to do	−0.0638*** (−3.52)	–	–
Personality traits			
Extraverted	0.0627*** (3.43)	0.0438*** (2.79)	−0.0281** (−2.07)
Frustrated	−0.169*** (−8.96)	–	–
Explorer	0.0675*** (3.78)	−0.0428*** (−2.81)	0.0295** (2.23)
Alone/Independent	–	–	0.0648*** (5.62)
Frugal	–	0.0283** (2.09)	–
Risktaker	–	–	−0.0401*** (−3.36)
Organized	–	–	0.0249** (2.02)
Responsible	–	−0.0824*** (−5.24)	0.0417*** (3.13)
Model parameters			
Constant	0.129** (2.33)	0.486*** (7.49)	−0.355*** (−6.81)
R^2 (Goodness of Fit)[b]	0.138	0.135	0.111

***, **, *Significant at 1%, 5%,10%, respectively

[a]These variables are based on statements asking participants what they feel they "have to, or are expected to do" and what they would "like to do" *on their commute*, and as such, should be read in the context of the commute

[b]These R-squared values are from simple regressions for the individual equations, and can be considered to be representative of the fit in the SURE model

Table 10 Estimated correlations of error terms (for unweighted model in Table 9)

	I do not mind waiting	Don't need to be equipped for a wait event	Waiting is okay if I expect it
I do not mind waiting	1.000		
Don't need to be equipped for a wait event	0.014	1.000	
Waiting is okay if I expect it	0.094	−0.432	1.000

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